HM Government

The Energy Challenge

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ENERGY REVIEW

A Report

JULY 2006

The Energy Challenge
Energy Review Report 2006

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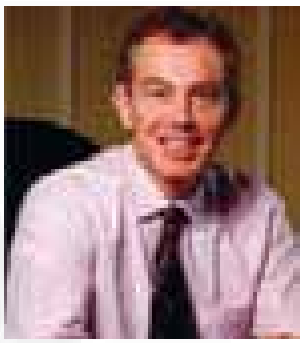
Contents

Foreword by the Rt Hon. Tony Blair MP



A clean, secure and sufficient supply of energy is simply essential for the future of our country. We need energy to heat and light our homes, to power our businesses and to transport people and goods. Without it, we could not function as an economy or modern society. Even minor disruptions in supply, after all, can cause major problems for communities and businesses. Ensuring we have a sustainable, secure and affordable energy supply is one of the principal duties of Government.

As a nation, we have been fortunate up to now that our energy needs have been met largely from domestic sources. Coal, with oil and gas from the North Sea more recently, have driven our economy. Investment in nuclear power has also provided a significant proportion of our electricity.

But we now face two immense challenges as a country – energy security and climate change.

First, we will soon be net importers of oil, and dependent on imported gas at a time when global demand and prices are increasing. Energy consumption by China and India, for example, is projected to double by 2030. At the same time, many of our coal and nuclear power stations are coming to the end of their lives. Without action to ensure reliable supplies and replace power plants, there will be a dramatic shortfall in our energy capacity and risks to our energy security.

Second, and even more important in the long term, is the impact that our sources and use of energy are having on our planet. The evidence is now compelling that the activities of humankind – and greenhouse gas emissions in particular – are changing the world's climate. Temperatures are rising and so are sea-levels. Extreme weather is becoming more common.

There is no scientific consensus yet on how much time we have to avoid dangerous irreversible climate change. But the overwhelming majority of experts believe climate change is already underway and, without collective action, will have a hugely damaging effect on our country, planet and way of life.

The prime source of greenhouse gas emissions is the production and use of energy. If we are serious about tackling climate change, the centrepiece of our programme – in the UK and across the world – must be in ensuring we power our economy and way of life in a cleaner, greener and more efficient way.

Overcoming these two major challenges – which are faced across the world – will require hard decisions both nationally and internationally. It was to consider our energy needs and to come up with long-term sustainable solutions that the Government set up the energy review last year. Its findings are the basis for this report.

The review underlines the fact that there is no simple, single solution to the energy challenges that we and other countries face but that a balanced approach, driven by technological advances and increased efficiency, will be needed. It also sets out a framework of action at home and abroad to strengthen our energy security.

It is clear that we must significantly increase investment in, and support for, renewable energy so that it plays a larger role in our energy needs. This is vital not just to give us a secure source of energy but also to meet our obligations to our children to tackle climate change. It is for the same reason that much greater emphasis must be given to finding alternatives to oil as an energy source for transport.

This document sets out how this can be done. But it also makes clear that wind, wave or solar power, let alone less established technologies, are not yet enough by themselves.

We need, as well, to put a much greater emphasis on the efficient use of energy. Such changes not only cut bills for organisations and families but also cut carbon emissions. The review sets out an ambitious strategy for securing more of the heat, light and power we need in ways that reduce the demand for energy and how now we can do much more to encourage its smarter and more efficient use.

This is not just a task for government, although government must give a lead. We will provide incentives to use cleaner fuels, work with power producers to provide more information about the costs and impact of energy use and with manufacturers and retailers to phase out energy inefficient products.

In the end, however, we must all – government, business and individuals – play our part by changing behaviour. If enough of us do, even small changes can make a big difference. If every UK household installed just three energy efficient light bulbs, the electricity saved would supply all our street lighting.

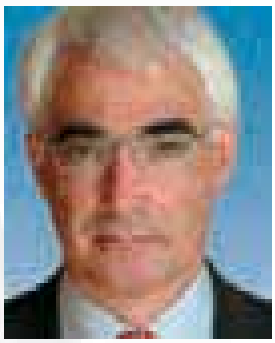
But neither renewable energy nor greater energy efficiency can provide the complete solution to the shortfall we face. This will depend on securing energy supplies from abroad, in new nuclear power stations to replace those becoming obsolete and replacing older coal-fired stations with cleaner, more efficient technology.

The review also calls for more effort to encourage and support the local generation of power. There is significant potential in the future to use small-scale local generation to provide affordable and reliable energy. All this is important both for limiting our dependence on imported gas and for tackling climate change.

Important as national measures are on climate change, it is only acting on an international basis that effective action can be taken. The UK, for example, only accounts for some 2% of global carbon emissions which are expected to rise by another 50% by 2030. It is vital, therefore, that the UK continues to give a lead internationally and to push for a post- 2012 framework that includes China, India and the US.

The scale of the challenges we face, both domestically and internationally, is great. The proposals included in this report set out how we can overcome them to secure our country's future prosperity and the health of our planet.

Preface by the Rt Hon. Alistair Darling MP



Energy is essential to just about every aspect of our life and to our continued economic prosperity. But today, we face two big challenges: climate change and security of energy supplies.

Without urgent action, at home and abroad, we face a damaging rise in temperature bringing with it a huge threat to our planet.

At the same time, the UK is entering a new era for energy supplies. For years, we have been self-sufficient in gas and oil, thanks to North Sea production. There are still many years of production there, but in future, we will increasingly depend on imports to meet demand. That is why it is so important to look for ways to cut demand for energy. Our aim must be to grow our economy whilst cutting waste and using every unit of energy as efficiently as possible.

In the UK it is estimated there is scope for saving many million tonnes of carbon dioxide each year through energy efficiency measures – from smart metering and energy saving lightbulbs, to a radical scheme to incentivise suppliers to save their household customers energy.

But this is only part of the story. We also need to look at the nature of the fuel we use. It is essential that we get the incentives right now for investment in low-carbon options, from offshore wind to tidal power, and even cleaner fossil fuels. Carbon capture and other measures could help us do more to reduce harmful emissions.

The mix of energy supply in the UK has served us well over many years. And that is essential for the future too. Cleaner coal, oil and gas, more renewable sources of energy. But we also need to look at nuclear power. It currently provides almost 20 per cent of the country's electricity needs, but most of these power stations are scheduled to close over the coming two decades. A good deal of our coal plant will also close. In the near term, some of this capacity will be replaced by renewables. Some of it is also likely to be filled by gas. But, if we do nothing, the reality is we will have to rely increasingly on gas. The 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.

Transport accounts for around 30 per cent of the total UK energy use, and around a quarter of carbon emissions. The Review includes a number of measures. If, to take one example, we were to double the use of biofuel, this could save another 1 million tonnes of carbon a year by 2015, equivalent to taking a million cars off our roads.

We also need to tackle problems with getting planning consent. We have a responsibility to ensure that our planning system deals with investment proposals in an efficient and timely way. Proper scrutiny and challenge will remain essential, but it is time to overhaul the present planning system.

Full implementation of the proposals and potential further measures set out in this report will get us on course to making real progress in emissions reductions by 2020.

They make a substantial contribution to meeting the challenge of climate change and of providing the cleaner and secure supplies of energy we need.

Introduction

Energy is a vital part of every aspect of life in modern Britain. The Government has four long-term goals for energy policy:

- 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.

In November 2005 the Prime Minister announced a major review of the country's progress on achieving these goals. The Review has been led by Malcolm Wicks, the Minister for Energy. This document is the Review's conclusions and it will be followed by a White Paper around the turn of the year.

We face two major long-term energy challenges:

- Tackling climate change, along with other nations, as global carbon emissions from human activity continue to grow; and
- Delivering secure, clean energy at affordable prices, as we become increasingly dependent on imports for our energy needs.

The scientific evidence for climate change, caused largely by the build-up of carbon dioxide and other greenhouse gases in the atmosphere, continues to strengthen. Without urgent action, there will be a damaging rise in temperature. Some 70% of global emissions come from the way we produce and use our energy. So energy policy has a vital part to play in tackling climate change.

If we are to effectively tackle climate change we need a global response with national governments taking action. We made progress last year at Gleneagles and Montreal. But we now need to accelerate discussions on a future framework for after 2012. Time is short. The UK is committed to the EU's 2 degrees Celsius objective which remains a valid objective in terms of avoiding dangerous global climate change impacts. In the next 12 months we need to begin to build a global consensus about the scale of the action we need to take, and the long-term goal we're all working towards.

The UK is entering a new era for our energy supplies. The North Sea has given us self-sufficiency in oil and gas, but this is now changing. In the future we will increasingly depend on gas imports to meet demand and by the end of the decade we will become a net importer of oil.

These developments are unfolding against a backdrop of rising global demand for energy as India, China and other countries rapidly grow their economies. Global demand for natural gas is projected to increase nearly twofold by 2030. The main reserves of oil and gas are concentrated in a few regions of the world: Russia, Central Asia, the Middle East, and Africa. Two countries – Russia and Iran – account for nearly half the world's proven gas reserves.

With energy demand growing, there is a risk that supplier countries don't make sufficient or timely investments to increase output to meet demand. There is growing competition between countries to secure energy supplies. And, of course, there are risks of political instability and weaknesses in governance.

As world demand for energy grows, national access to adequate energy supplies will become an increasingly important strategic objective. It is critical that the UK has access to the energy we need to support our economic prosperity. We must be alert to any steps by other nations to deny fair and open access to energy reserves.

Combined with a strong international policy, we must promote the growth of our own home-grown energy resources – from maximising output from the North Sea to microgeneration (small scale generation of heat and electricity for homes or buildings).

We believe that the UK's framework of competitive markets, regulation and public policy is sound, but we have concluded that within that framework there is a need for new policy initiatives if we are to meet the very significant challenges we will face in the coming decades.

This report sets out the next steps we need to take in responding to the energy challenges facing the United Kingdom. It makes a number of proposals for actions to be taken now, identifies proposals on which Government intends to consult further, and indicates areas where Government considers there is further work to be done. In doing so it explains how we will work with the devolved administrations to identify action in areas of devolved responsibility which will help us achieve our shared goals.

As we build our energy future, it will be vital to ensure that the talents of our science base help us achieve our energy goals to reduce emissions and maintain reliable supplies. We therefore announced in the 2006 Budget that we shall establish a National Institute for Energy Technologies.

Executive Summary

The Carbon Challenge

The world's economies need to get on a path to being significantly less carbon-intensive. This means using less energy in our products and services and changing the way we produce energy so that more of it comes from low-carbon sources.

A key step to achieving this in Europe has been the introduction of the EU Emissions Trading Scheme (ETS). By putting a price on carbon it creates a strong economic incentive for more energy efficiency and investments that help reduce carbon emissions. The Government is determined to ensure that the EU ETS develops into a credible long-term international framework for pricing carbon.

To achieve this we are working with the European Commission on proposals for the third phase of this Scheme – which should be more ambitious in reducing carbon across the EU than previous phases – to begin in 2013. We need a strengthened ETS; key to this is signalling the direction of EU emissions reductions over a longer period into the future than the five years in phase II. This will give more certainty to companies planning long-term investments in power stations and other energy intensive assets. We will 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 to investors.

On present policies, the UK is on course to exceed its target under the first commitment period of the Kyoto Protocol, which is to cut greenhouse gas emissions by 12.5% on 1990 levels throughout the period 2008-2012. The welcome strong performance of the UK economy over the past nine years has, however, led to growing energy consumption. This growth combined with higher levels of electricity generation from coal has led to higher carbon emissions in the UK. So we now need to take further action to help us move towards the goal of cutting carbon emissions by 60% by 2050.

Saving energy

The starting point for reducing carbon emissions is to save energy. The challenge is to secure the heat, light and energy we need in our homes and businesses in a way that cuts the amount of oil, gas and electricity we use and the carbon we emit.

Progress on energy efficiency requires all of us – companies, individuals and Government – to recognise that we have a role to play. The main obstacles to the take up of energy efficiency are lack of information about costs and benefits, absence of appropriate incentives, and lack of motivation among consumers. We propose measures that will provide individuals and companies with more information and clearer incentives to make better use of energy.

In total by 2020, we estimate the measures we propose on energy efficiency[1] could be a saving of 6 – 9 MtC (million tonnes of carbon), around 4 – 6% of our total emissions in 2005, on top of the 12 MtC saving that will come from the policies announced in the 2006 Climate Change Programme by 2010.

In our homes people need more information about the amount of energy we use and its environmental impact. We should require energy suppliers to provide their customers with more information about their energy use over time and advice on saving energy. There are other tools coming that will also help householders. Trials are starting this year to test the impact of a range of modern technologies in providing real-time information to households about their energy use. And the new Home Information Packs, provided to all new buyers and tenants, will include comprehensive data on the energy efficiency of the house.

We will lead a drive to raise basic standards of energy efficiency. Working with other governments, manufacturers and retailers, we will seek to phase out the least efficient light bulbs, remove the most inefficient white goods from the market and limit the amount of stand-by energy wasted on televisions, stereos and other consumer electronics.

We are already building new homes that are much more energy efficient than previously. For example, new homes use around a quarter of the energy to heat and light compared with the average existing home. We will put in place measures to take us towards our long-term ambition of making all new developments carbon neutral. These measures will provide strong support for the use of on-site electricity generation, such as solar panels or mini wind turbines.

And we are proposing to look at how we can radically transform the role of energy supply companies so that they have strong incentives to work with their customers to get more out of the energy we use in our homes, rather than simply selling more energy.

The EU Emissions Trading Scheme and the Climate Change Levy are the key instruments to encourage business to save energy and cut emissions. But there is wide potential to make cost-effective energy savings – around 1.2 MtC by 2020 – in many businesses and public services not covered by the EU ETS and we will bring forward proposals to incentivise making those savings. We shall consult on a proposal for a mandatory emissions trading scheme – an Energy Performance Commitment – alongside other options, for achieving our carbon reduction aims in this sector.

Government too has to change its behaviour and take energy efficiency even more seriously in the buildings and operations it is responsible for. We will change the way Government procures buildings, goods and services in order to reduce energy use across the central Government estate. We aim to make the central government estate of buildings carbon neutral by 2012, with any shortfall to government targets 'offset' by payment into a central fund and ploughed back into sustainable energy projects.

1 Including carbon savings from recent announcements on carbon neutral developments and carbon neutral Government.

Energy saving measures will also help us meet our security of supply objectives. For example, the proposals outlined in this paper will reduce gas consumption by between 11 and 15 billion cubic metres in 2020 (roughly 10 – 13% of expected gas consumption by 2020).

More energy efficient transport

Transport accounts for around 30% of total UK energy use (mostly from oil) and around 25% of UK carbon emissions. Emissions from road transport in the UK are projected to peak around 2015 and thereafter fall as growth in demand for transport moderates, fuel efficiency in transport continues to improve and we start to use more lower-carbon fuels, especially biofuels. However, there may be more cost effective opportunities to save carbon in the longer term as new technologies are developed and applied.

Government has established the principle that fiscal measures can play a part in achieving our environmental goals and will continue to examine how fiscal and other policy instruments can achieve these aims. Company Car Tax and Vehicle Excise Duty have already been reformed to reflect this, and combined with savings expected from the Voluntary Agreement on new vehicle fuel efficiency, these measures are expected to deliver reductions of 2.3 MtC in 2010.

We will continue to press the European Commission to seriously consider the inclusion of road transport in the EU Emissions Trading Scheme, potentially saving between 4 and 7 MtC in 2020. And we are working to get aviation included in the EU ETS as well.

We are also pressing for new EU targets on new car fuel efficiency to be finalised as soon as possible. We believe the Commission should consider all options for ensuring these targets are met, including mandatory targets with trading. We will also seek to raise awareness amongst consumers so that they can make informed choices about the type of cars they buy and how they use them.

Cleaner energy

Cost-effective ways of using less energy will help move us towards our carbon reduction goal. But on their own they will not provide the solution to the challenges we face. We also need to make the energy we use cleaner.

Distributed energy generation, including low-carbon heat

Most of our electricity is generated in large power stations, and around three quarters of our heat comes from gas fed through a nationwide network. This centralised model delivers economies of scale, safety and reliability. But a combination of new and existing technologies are making it possible to generate energy efficiently near where we use it, potentially delivering lower emissions, increased diversity of supply and in some cases lower cost.

A 'distributed energy' system using these technologies could radically change the way we meet our energy needs in the long-term. Heat and electricity can be created locally from renewable sources. Where we use fossil fuels, local generation allows us to capture the heat generated in that process and use it

nearby. Smaller-scale systems have the potential to be more flexible and to reduce the energy we lose in networks. And a more community-based energy system could lead to a greater awareness of energy issues, driving a change in social attitudes and, in turn, more efficient use of our energy resources.

It is not yet a question of leaving our centralised system behind. Less than 1/2% of our electricity comes from microgeneration, and Combined Heat and Power plants (capturing the heat from electricity generation) provides about 7%. Most small-scale renewables, for now at least, are expensive compared to large power stations. And there will be tough transitional issues. To capitalise on our best renewable resources, for example, we need to continue extending our networks to the remote locations where they are found.

To understand its true long-term potential, and the challenges we face in getting there, we will commission a high-powered investigation of the potential of distributed energy as a long-term alternative or supplement to centralised generation, looking at the full range of scientific, technical, economic and behavioural issues.

But we must grasp the opportunities offered by distributed energy today. Government is therefore taking forward a series of measures to encourage the use of low carbon and distributed technologies, with action at community level and to encourage individuals. We will be removing barriers, where viable, in planning, in selling electricity and in accessing the benefits of the Renewables Obligation. We are encouraging Local Authorities to take action appropriate to their communities, and will be announcing new powers and duties for the Mayor of London. There will also be the potential to use the recently announced Environmental Transformation Fund (ETF)[2] to encourage distributed generation.

And with Ofgem we will undertake a comprehensive review of the economic and other incentives that currently impact on distributed generation, including those that affect energy supply companies and the operators of distribution networks.

Large scale electricity generation

Over the next two decades, it is likely that we will need around 25 GW (Giga Watt) of new electricity generation capacity, as power stations – principally, coal and nuclear plants – reach the end of their lives and close. This will require substantial new investment and is equivalent to around one third of today's generation capacity.

Power station investments are long term and we need to have in place the right framework to incentivise those investment decisions to be made at the right time and to limit carbon emissions, helping us lock in substantial carbon savings for years to come.

Over the next few years, new investment is likely to be in renewables, especially wind, and gas-fired power stations. Longer term, there are other low carbon forms of generation that can contribute to meeting our goals.

2 The Environmental Transformation Fund was announced in June 2006. The fund will provide a boost to investment in renewables and other low carbon technologies.

We propose a number of measures to improve the market framework for investment:

- a strong commitment to carbon pricing in the UK, through improving the operation of the EU Emissions Trading Scheme
- a strengthened commitment to the Renewables Obligation
- proposals for reform of the planning regime for electricity projects
- a clear statement of our position on new nuclear build
- new arrangements for providing improved information about future trends in energy supply.

Renewable electricity

Renewable energy is an integral part of the Government's strategy for tackling climate change. We propose a range of measures to promote its growth – taken together we believe we can achieve 20% of our electricity coming from renewable sources by 2020.

The Renewables Obligation (RO) is the key support mechanism for the expansion of renewable electricity. It has succeeded in bringing forward major developments of the most economic forms of renewable energy, in particular onshore wind, landfill gas, and co-firing of biomass in coal power stations. The cost of the RO is met by electricity consumers. It allows renewable energy, which is currently more expensive to produce than coal, gas or nuclear, to be competitive with them. Its rationale is that, as these are new technologies, they are yet to achieve the full economies of mature technologies. We propose to strengthen the RO in two ways.

First, we will increase the level of the RO. At present, it is due to rise to about 15% in 2015-16 and remain at that level till the Obligation ceases at the end of 2026-27. We now plan to ensure that the level of the Obligation always stays above the level of renewables actually installed, up to a 20% obligation. This will boost investors' confidence in the returns they can make from their projects.

Second, we propose to consult on adapting the Renewables Obligation to reflect the fact that some technologies are better-established and no longer need the full support of the Obligation, and so that it begins to provide more support to emerging technologies – such as offshore wind. We propose to consult on whether and how we might "band" the Obligation to provide differentiated levels of support to different renewable technologies. Any change would not be introduced until 2009 or 2010. The new arrangements would not apply to projects in operation before the changes were introduced.

In this report, we set out the strategic role of renewables in the energy system. We also announce that we will consult on changes to the planning inquiry rules. Taken together, these should help reduce planning delays to renewable projects while recognising the rights of people to object to applications.

Much of our renewable resource, potential and planned projects are to be found in Scotland, where the promotion of renewable energy is the responsibility of Scottish Executive Ministers. We will work with them to deliver on our UK-wide targets.

Renewables should also benefit from the Environmental Transformation Fund.

This boost for renewables will add carbon savings of around 0.7 – 1.5 MtC per year by 2020 to the savings the RO is already helping to deliver. Our proposals will not increase the impact of the RO on bills. Additional renewables will also contribute to our security of supply goals, for example by displacing gas power stations that might otherwise be built (around 1 – 2% of gas consumption in 2020).

Replacing nuclear power stations

Nuclear power is currently an important source of low carbon electricity in the UK. The existing fleet of nuclear power stations will close in the years ahead. Our assessment is that higher projected fossil fuel prices and the introduction of a carbon price to place a value on CO_2 have improved the economics of nuclear as a source of low carbon generation.

We have concluded that new nuclear power stations would make a significant contribution to meeting our energy policy goals. For illustrative purposes, if existing capacity were replaced, then by 2030 our carbon emissions would be around 8 MtC lower – equivalent to total emissions from twenty two 500MW (Mega Watt) gas-fired power stations – than otherwise, and our gas consumption some 13% lower.

It will be for the private sector to initiate, fund, construct and operate new nuclear plants and to cover the full cost of decommissioning and their full share of long-term waste management costs. But in view of the potential benefits for our public policy goals, the Government proposes to address potential barriers to new nuclear build.

By early next year, the Health and Safety Executive will develop guidance for potential promoters of new nuclear power stations. This will explain how they can obtain assessment of possible reactor designs before committing significant sums to planning and construction.

On nuclear waste, the report of the Committee on Radioactive Waste Management, due later this month, following its interim report published in April, will provide the basis for a decision on the long-term management of waste by the Government and the Devolved Administrations.

We are also setting out a proposed framework for considering the relevant issues and context in which planning inquiries should be held. This would be set out in the Energy White Paper to be published around the turn of the year. To support preparation of this White Paper, we are consulting on the proposals outlined in annex A of this document.

For nuclear new build, considerations of safety and security will be paramount, as they are with the regulation of our existing nuclear plant.

Cleaning up fossil fuels

The Government believes that coal has a role to play in our generating mix. During this winter over 50% of our electricity generation came from coal-fired stations, underlining the benefits coal brings in delivering secure electricity supplies. To have a long-term future coal needs to tackle its heavy carbon

emissions. Carbon Capture and Storage (CCS) is an emerging technology which could reduce the carbon emissions of coal or gas power stations by 80 to 90%. If CCS were economic and technically feasible on a large scale, it could deliver substantial reductions in carbon emissions, not just in the UK, but also in rapidly developing countries such as China and India.

The UK has some natural and commercial advantages – such as a strong oil industry and old oil fields where carbon dioxide could be stored – that mean we could be well placed to benefit from this technology. We will therefore continue to work with international partners on CCS and to remove regulatory barriers. The Government believes that the next step in the development of CCS would be a commercial demonstration, if it proved to be cost effective. Following HM Treasury's recent consultation on CCS, more work will be undertaken on the costs of such demonstration projects, and a further statement will be made at the Pre-Budget Report. Successful demonstration could lead to CCS saving several million tonnes of carbon on an annual basis in the 2020s.

Developing alternative fuels for transport

Alternatives to petrol and other fossil fuels are already being used in a variety of forms of transport. But it will take decades before we see a real shift away from oil as the predominant fuel source. We propose a Transport Innovation Strategy that will help to bring forward cleaner technologies and fuels. We also intend that the level of the Renewable Transport Fuel Obligation should rise above 5% after 2010/11. Provided certain conditions are met, and for example we were able to raise the level of the obligation to 10% by 2015, we would save a further million tonnes of carbon a year, equivalent to removing another 1 million cars from our roads.

The Energy Security Challenge

Security of supply

The challenges of reducing carbon emissions and ensuring security of supply are closely linked. Security of supply requires that we have good access to available fuel supplies, the infrastructure in place to transport them to centres of demand and effective markets so that supply meets demand in the most efficient way. Many of the measures already described for tackling carbon emissions also contribute to the healthy diversity of energy sources that is necessary for meeting the energy security challenge.

There are two main security of supply challenges for the UK:

- Managing increased dependence on oil and gas imports; and
- Ensuring that the market delivers substantial and timely investment in electricity generating capacity and networks so that households and businesses have the electricity they need at affordable prices.

With production from our own reserves of oil and gas in decline we will increasingly rely on international markets to give us access to the supplies we need. For example, we could be importing as much as 90% of our gas needs by 2020 compared with 10% or so now. This brings risks:

- The largest global reserves of oil and gas are concentrated in Russia, Central Asia, the Middle East, and African countries. We shall become increasingly reliant on supplies from these regions.
- Global energy demand is forecast to grow strongly. This will mean greater competition for supplies.
- There is a risk that supplier countries may not make sufficient or timely investments to increase output.
- The global oil market has tightened, with a decline in spare production and refining capacity. The OPEC share of the crude oil market is projected to increase from 40% now to around 50% by 2030.
- Unlike oil, gas is not currently traded in a global market. While increasing shipments of Liquefied Natural Gas may make the market more flexible, gas is now largely supplied into regional markets and constrained by access to pipelines which may cross many countries.
- Overall, these trends could put upward pressure on prices and encourage increased political intervention in international energy transactions.

Our response

We need to respond to these challenges with:

- A strong international agenda to promote more open and competitive markets.
- A market framework in the UK that is positive for investment and diversity of supplies and for the growth of our own home-grown energy.

Our international agenda is active on three fronts.

First, bilaterally, we are building stronger political relationships with energy producers to ensure UK energy suppliers have fair access to energy supplies.

Second, within the EU, we are backing the Commission in securing effective implementation of a competitive, liberal energy market. This will address anti-competitive behaviour and ensure more reliable UK access to gas coming into European networks.

Third, multilaterally, we are working to strengthen the dialogue between consumers and producers so there is a better common understanding of the mutual benefits of investment in exploration and production, rapid deployment of cleaner and more efficient technologies, and open trade in supplies.

For the UK, the Government believes that the best way to maintain energy reliability is through energy diversity – in our sources of energy, our suppliers, and our supply routes. Competitive markets can help us achieve diversity, as companies themselves seek diversity in order to manage risks.

Market information and projections

We need to improve the quality of information and analysis about the outlook for gas and electricity supplies. This should make the market work more effectively, and it will help government judge how far our regulatory framework looks likely to deliver reliable supplies. Currently, the Joint Energy and Security of Supply working group is designed to bring together market information, helping investors make informed choices. We shall bring forward proposals in the autumn to build on and improve these arrangements.

Securing electricity supplies

The large investment needed in new electricity generation will be a big test for our market-based system. The incentives for companies to build new power stations need to be consistent with the economy's need for capacity to be added in a timely way. We shall continue to monitor the investment outlook very closely, including through the new arrangements described above. It will be particularly important for the market to respond to the prospect of significant coal power station closures in the period up to 2015, brought about by EU environmental legislation. Adequate investment in transmission networks will also be essential. Ofgem are consulting on proposals to allow a big increase in investment over the period 2007-2012.

By setting out in this report the Government's position on renewables, nuclear power, and carbon pricing, we believe we will provide energy companies and investors with greater clarity about the future. The proposals set out in this report to streamline and simplify the planning process for large-scale energy projects should reduce delays in delivering the significant new investment the country will need to meet its energy demands over the coming years.

Coal

Coal-fired generation continues to meet around one third of electricity demand on average and during the winter of 2005/6, in response to high gas prices, it met about half of demand. This illustrates the important contribution made by coal-fired generation to the UK's energy security and the flexibility of the UK's energy system.

The future for coal must be to become cleaner. "Clean coal", in particular CCS, can make this a reality.

Generators have already recognised the importance of coal and have committed significant investment to enable 20GW, or about two thirds, of existing coal-fired capacity to comply with new EU legislation. Coal-fired generation will therefore continue to play an important role in the UK's energy system, provided that its environmental impact can be managed effectively.

The Government will convene a coal forum to bring together coal-fired generators, coal producers and suppliers, power plant suppliers, trade unions, small businesses and other parties in order to help them to find solutions to secure the long term future of coal-fired power generation and UK coal production.

Securing gas supplies

There are three elements in our strategy for securing our gas supplies:

- maximising economic recovery from the North Sea;
- limiting our dependence on gas; and
- managing the risks in higher gas import dependence.

Maximising exploitation of UK oil and gas reserves

Estimates of the oil and gas remaining to be produced from the UK Continental Shelf (UKCS) range from 21 to 27 billion barrels of oil equivalent. Analysis suggests that if the higher estimates are right and if investment in exploration and development can be maintained near current levels, then

production in 2020 could be equivalent to a million barrels day higher than if investment falls away (split roughly equally between oil and gas production).

The underlying geology and future oil and gas prices are the dominant drivers of investment and hence ultimate recovery levels. But we have identified actions that could be taken now to boost the attractiveness of investment in the UK compared to other regions of the world. This will help recovery from fields that are already producing and establish infrastructure to the west of Shetland for our undeveloped heavy oil resources. The Treasury's review of the fiscal framework will also be important.

Limiting UK gas dependence

It will be for energy producers and consumers to decide how much gas we should use within the market framework we have established. But the action we are taking in support of our carbon goals should have the effect of reducing the amount of gas we need in our economy and hence our demand for imports.

But gas will continue to be needed for heat because at present there are no cost effective alternatives that could be implemented at scale. And the economics of gas-fired power stations are likely to mean they remain attractive for new investment.

Managing gas import risks

Many countries, including most of our competitors, are already energy import dependent and have been for many years. Whilst we should avoid excessive dependence on gas as a single source of our energy, it will continue to play a very important role. So we will need to prepare for higher levels of imports and manage the attendant risks.

Promoting more open and competitive international markets, is central to our strategy for managing a much higher level of gas imports.

Facilitating the timely construction of sufficient storage and import infrastructure to meet our energy needs is also critical. The private sector has already responded to our increasing import requirement by committing £10bn of investment in new gas pipeline and storage projects. As with electricity, Ofgem is consulting on proposals that would allow a big increase in gas network investment over the next five years. We will need to find the right balance between the national need for timely delivery of this infrastructure and local concerns as these projects come through the planning system. We propose to consult in the autumn on measures to improve the consenting regime for gas infrastructure.

We also need to review whether there are clear enough incentives for the UK market to develop sufficient flexibility – including, for example, gas storage – to meet these challenges. We shall seek the views of energy suppliers and users on the effectiveness of current gas security of supply arrangements, and whether they need strengthening as we become more dependent on gas imports.

Delivering competitive prices through effective markets

Over the past decade, the UK has benefited from the most competitive gas and electricity markets in the EU and G7 with prices in the UK decreasing substantially since energy market liberalisation. However as the UK increasingly becomes a net importer of energy, we may be affected by the interaction of the UK's liberalised energy market with the less liberalised energy markets in the rest of the EU.

The UK suffered some very high prices this past winter. Despite this, flows through the UK-Belgium gas interconnector averaged 60% of total capacity which indicated that the EU market was not responding to price signals as would be expected in a competitive market. We asked the Commission to investigate, specifically to establish whether this may have been due to abusive behaviour or distortions in the wider EU gas market. We are awaiting the results of the Commission's inquiry.

Two recent reports from the European Commission on the functioning of EU electricity and gas markets identified serious problems: the high degree of market concentration; vertical integration being used as a barrier to new entrants; the lack of market integration; the lack of transparency; and the lack of well functioning and transparent market mechanisms for setting prices. These problems have led to significant extra costs for UK consumers

We will continue our drive for EU energy markets liberalisation and integration, by working with the European Commission to enforce and strengthen internal market legislation and to make full use of European competition rules to tackle anti-competitive practices, and to influence the future direction of European energy policy as set out in the European Commission's Green Paper[3].

We also remain committed to improving the functioning of the UK's energy markets as the best way to deliver competitive prices. Our proposals improve the effective functioning of UK energy markets through:

- greater information transparency leading to more informed investments and decision making;
- improved planning helping to facilitate investments coming onstream in a timely way and
- a consultation on whether our gas security of supply framework is fit for purpose as we become increasingly import dependent.

These measures should reduce pressure on fossil fuel prices and the likelihood of price volatility. Our proposals to improve energy efficiency should also help reduce the energy bills of business and household consumers.

Protecting vulnerable consumers

Everyone should be able to afford an adequate energy supply and live in a warm home. Between 1996 and 2003, considerable progress was made in tackling fuel poverty, with the number of UK households in fuel poverty falling from 5 million to around 1.5 million.

3 "A European Strategy for Sustainable, Competitive and Secure Energy" published on 8th March 2006.

This was thanks to a range of factors – not least economic growth, progress in tackling poverty in vulnerable elderly households and households with children, and specific fuel poverty policies. Those policies include the Winter Fuel Payment, and the Warm Front programme and its equivalents in the Devolved Administrations, under which 1.5 million homes across the UK have received assistance. Rising fuel prices mean that fuel poverty remains a major long-term challenge. We will therefore take steps to better target existing support. And in dialogue with energy companies and other interested parties, we will keep our policy framework under review.

What do our proposals deliver?

By implemeting these proposals, the UK will be much better able to respond to the increased risks associated with the move to increased UK gas import dependence and the need for substantial new investment in electricity generation.

And on climate change, full implementation of these ambitious proposals will be a significant step in the right direction, getting us on course to achieve real progress in emissions reductions in 2020 and on the right path to achieving our goal of cutting the UK's CO_2 emissions by 60% by 2050.

Carbon emissions would be between 19 and 25 million tonnes lower in 2020 than our current projections. That's a cut of 13 – 17% on what we anticipate our 2020 emissions would be otherwise.

We are proposing to establish a new Office of Climate Change, which will monitor progress towards our carbon goals and ensure coherence of action across Government departments to achieve them. And we shall continue to study the merits of carbon budgeting as a means of helping deliver our goals.

In taking forward the proposals and further work set out in this report, we will continue to consider the regulatory impact our proposals will have on different groups and sectors within our society. These include companies and organisations that will play a direct role in helping us deliver our objectives – such as energy suppliers, regulators, and local and regional authorities – as well as businesses and individuals who will be affected by new requirements arising from our proposals – product manufacturers, retailers, and homeowners for example.

The Government is clear in its determination to achieve its energy policy objectives through an approach that is consistent with the principles of good regulation. Over the coming months, we will work to refine our estimates of the benefits the measures in this report are expected to deliver and the policy and administrative costs that will arise. Only measures that are well-targeted, reasonable and proportionate will be implemented. We will assess this on a case-by-case basis, while having regard to the collective regulatory impact on business and other parties.

Introducing Chapters 1-9

The following chapters set out the detail of the Government's proposals. Many of these proposals help us make progress against more than one of our energy challenges.

- Chapter 1 sets out our overarching approach to saving carbon and giving incentives to reduce carbon dioxide emissions.

- Chapter 2 sets out the Government's proposals to increase the efficiency of the products and services we use at work and at home and to improve the standards and heat efficiency of buildings.

- Chapter 3 sets out the Government's proposals on distributed energy. This includes proposals on combined heat and power (CHP), microgeneration and proposals to encourage the development of renewable forms of heat.

- Chapter 4 sets out the Government's proposals on oil, gas and coal. This includes steps to make international markets for oil and gas work better; to encourage companies to maximise investment and production from the UK's fossil fuel resources; and to help reduce the risks associated with the UK's increasing reliance on gas imports.

- Chapter 5 examines the electricity market and the need for substantial new investment in power stations over the next two decades. This includes proposals on renewables, cleaner coal and carbon capture and storage and on civil nuclear power.

- Chapter 6 discusses the steps Government will take to reduce carbon dioxide emissions from transport.

- In chapter 7, we set out the steps the Government will take to improve the planning process for all energy infrastructure. The proposals include planning improvements for gas infrastructure (e.g. pipelines, LNG terminals and gas storage) and electricity generation, including renewables, CHP, fossil fuel and nuclear power stations.

- Chapter 8 highlights the progress the overall package of proposals could help us make by around 2020 towards addressing our energy challenges. In this chapter, we also describe the potential for future technologies to help us make more rapid and cost-effective progress in the coming decades.

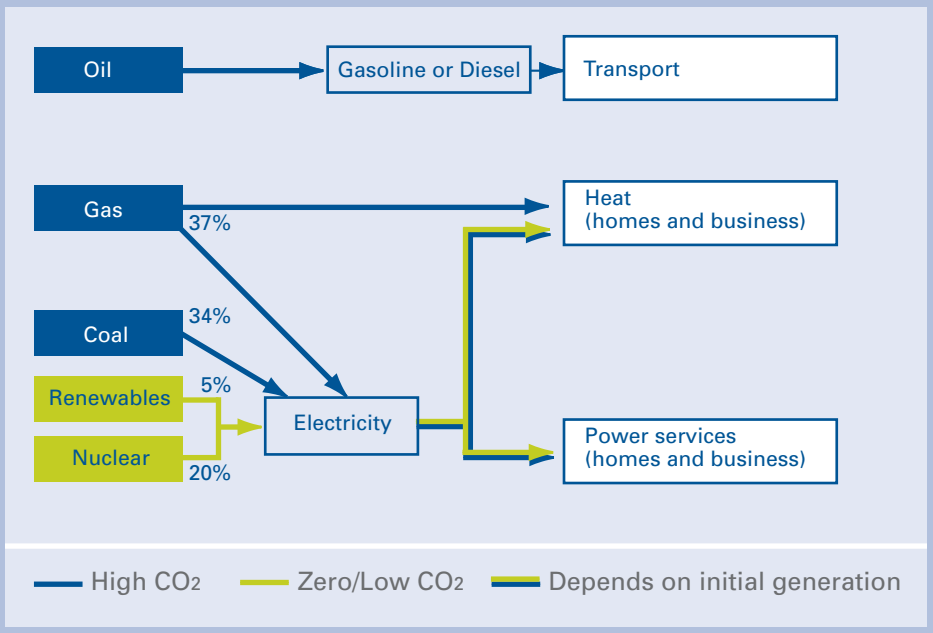
- Finally, in chapter 9, we summarise the next steps, including the actions and timing of the proposals and consultations we plan to launch after the summer.

BOX 1: THE UK ENERGY SYSTEM

Energy is essential to nearly everything we do. We use it in transport, to generate the heat that we use in homes and businesses and to power our lights and other appliances. Increasingly we are learning how to use natural and renewable sources of energy such as sunlight, water, wind and crops to meet these needs. We remain however, heavily reliant on fossil fuels which, when burnt, release greenhouse gases.

For transport we currently rely almost entirely on oil – 99% of our road transport relies on it, in the form of petrol or diesel.[4] Indeed oil and transport are intimately linked, with around 74% of our oil going to transport. Heat is generated mainly from gas, but we also use electric heaters and burn small amounts of oil, coal and other natural substances. For lighting and the powering of appliances, we use electricity. Capturing only the major flows from raw fuel through to end use, we might think of our energy system in simple diagram form:

CHART 1: THE UK ENERGY SYSTEM



Source: DTI, 2006

Electricity plays a key role in this system. It is not a fuel, but rather a conduit of energy generated from a mixture of coal (34%), gas (37%), nuclear (20%) and renewables (5%)[5]. When the use of fossil fuels to generate electricity is added to their uses in transport and providing heat, we get a full picture of our reliance on fossil fuels.

4 DTI Energy Flow Chart. 2004, www.dti.gov.uk/files/file11248.ppt
5 The remaining 4% consists mainly of electricity imports and oil.

CHAPTER 1

Valuing Carbon

The only way in which the international community will limit the rise in carbon emissions is if governments, industry and individuals take into account the costs associated with the emissions for which they are responsible. A key role for Government is to put in place a framework which, by placing a value on carbon, provides a financial incentive for businesses and households to incorporate the climate change impact of their activities.

1.1 A carbon price is essential for making lower carbon emissions a business imperative. Companies that face a price for carbon will be incentivised to reduce their emissions, either through energy efficiency improvements, investing in new technology, or switching to the use of less carbon-intensive sources of energy.

1.2 Establishing a price for carbon is best done internationally because climate change is a global problem requiring collective action. Reducing carbon emissions can incur costs. These costs differ depending on country, sector and company specific factors. Acting together through international agreements provides the widest range of options for reducing carbon emissions, so that the most cost-effective can be taken up first. It also avoids potential distortions in international competitiveness.

1.3 The UK's carbon policy framework comprises a number of international and domestic policy measures. Some of these generate a value for carbon directly (such as the Climate Change Levy); others generate an effective price through a regulatory framework (such as the European Union Emissions Trading Scheme (EU ETS), the Renewables Obligation and the Energy Efficiency Commitment).

1.4 The introduction of the European Union Emissions Trading Scheme (box 1.1) in January 2005 effectively created the world's first international carbon market. The UK has played an active role in the creation and development of the EU ETS, which forms the cornerstone of our carbon policy framework.

BOX 1.1: THE EUROPEAN UNION EMISSIONS TRADING SCHEME (EU ETS)

The European Union Emissions Trading Scheme (EU ETS) represented a major step forward in EU action to reduce emissions from carbon. The EU ETS currently covers around 11,000 power stations and large businesses across Europe, responsible between them for about half of the EU's carbon emissions. Each Member State sets a target level of emissions and allocates 'allowances' to emit carbon dioxide (measured in tonnes).

BOX 1.1 continued

The overall number of allowances allocated should be set below industry's normal emissions levels; each company with a shortfall must either reduce its own carbon emissions or buy allowances from other companies. This enables companies who can easily lower their carbon emissions to make large cuts in emissions and sell their allowances to those who find it harder to do so. The benefits of creating such a market is that it allows emissions reductions to occur where it is most cost-effective.

The buying and selling of allowances between companies creates a carbon price (expressed in Euros per tonne of carbon dioxide – €/tCO_2). The trading periods for buying and selling run in set phases. Phase I of the scheme covers the period 2005 to 2007, with the second phase running from 2008 to 2012.

Any emitter that does not hold sufficient allowances to cover its emissions is liable to pay an 'excess emissions penalty' of €40 for each tonne of carbon dioxide emitted not covered by allowances under Phase I (rising to €100 in Phase II). Even having paid the financial penalty, the developer will still have to ensure they hold an amount of allowances which includes the excess emissions in the following year, thereby creating further incentives to reduce emissions rather than face the penalty.

The EU ETS does not, in itself, determine the amount of carbon emissions saved within the UK over time – this will be determined by the price of carbon (which is determined internationally) relative to the cost of lowering emissions in the UK. If investment in reducing carbon emissions in the UK remains expensive relative to the EU and beyond, the effort we require of industry in the UK will not necessarily translate into emissions reductions here. But emissions will be reduced globally through the efforts of UK organisations. This is important, given the need to reduce concentrations of greenhouse gases on a global scale, and for these reductions to take place in the most cost-effective way.

In some cases, UK efforts to reduce carbon emissions also may result from investment in one of the 'flexibility mechanisms' under the Kyoto Protocol to which the EU ETS is linked. These are the:

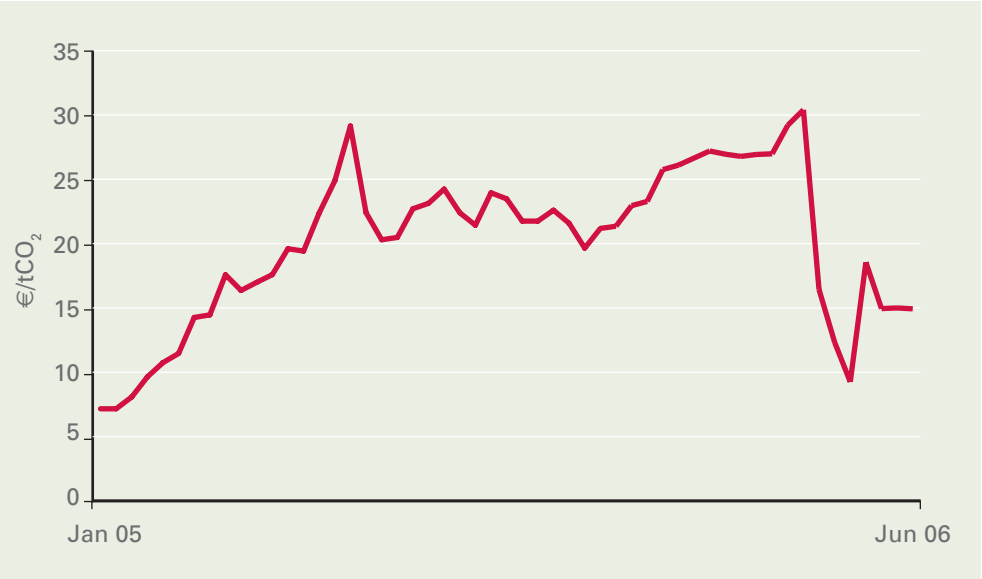
- Clean Development Mechanism (CDM) – a mechanism that allows developed nations to achieve part of their reduction obligations under the Kyoto Protocol by funding projects in developing countries that reduce emissions; and

- Joint Implementation (JI) – a programme under the Kyoto Protocol that allows industrialised countries to meet part of their required cuts in greenhouse gas emissions by paying for projects that reduce emissions in other industrialised countries).

1.5 The market for carbon under the EU ETS is still developing, but already around €7.2 billion worth of carbon trading has occurred in the first year of the EU ETS, with a growth in financial products, and a massive upsurge in investment in the Clean Development Mechanism (CDM) – from $400 million in 2004 to $1.9 billion in 2005.

1.6 The volatility in the carbon price since the EU ETS began (see chart 2) reflects, in part, a nascent EU ETS that is continuing to develop and evolve. But the price volatility also reflects some of the underlying aspects of the EU ETS (such as current information reporting arrangements) that need to be strengthened in order to improve its future effectiveness.

CHART 2: THE EU EMISSIONS TRADING SCHEME ALLOWANCE PRICE, JAN 05 – JUN 06



Source: DTI, 2006

1.7 There is uncertainty for investors regarding the coverage and structure of future phases under the EU ETS. A clear and stable long-term carbon policy framework is important for creating the confidence and certainty that is needed to underpin changes in industry behaviour. This is particularly important for investments in long-lived assets (such as power stations) because the profitability of such investments is affected by the carbon price years into the future, along with other factors, such as fuel prices, technology risk and regulatory/planning risks (some of which are discussed in other parts of this report). Investors have to take a view on how these factors will change over time, affecting the returns on their investment. But the carbon price is generated through a scheme which operates under parameters (for example, caps on emissions) set by governments. Uncertainty over the future shape and development of these parameters will create difficulties for investors.

1.8 A number of factors could reduce this uncertainty. For instance, the European Commission has made strong statements on its intention to ensure real scarcity of permits in the EU ETS for Phase II, stating it will use all the political and legal tools at its disposal to do so. The reconciliation results of the first year of the first phase of the Scheme will provide a more reliable base for the Commission's assessment of plans.

1.9 However, while the market for carbon allowances is likely to become progressively tighter, certain factors (such as legislative delays) could lead to a lack of market clarity. In the absence of a clear and stable carbon policy framework, investors may consider delaying investment decisions. If investment is not timely, this could create risks of a tighter supply-demand balance in the electricity sector (and hence potential energy price volatility). The absence of such a longer-term framework may also discourage investment in low carbon technologies. This could undermine the ability to deliver significant carbon savings towards our 2050 goal.

1.10 The Government is fully committed to the EU ETS – it is the best long-term mechanism for securing least-cost emissions reductions across the EU. The EU ETS has the potential to form the basis of a long-term global carbon trading market. It will remain the central element of the UK's emissions reductions policy framework, with its continued existence beyond 2012 assured under European legislation, which includes rules for setting the level of emissions reduction required.[6]

1.11 Phase II of the EU ETS will play a critical role in helping to set the future direction of travel for the EU ETS. Government recently announced a cut in the UK's allocation of 8MtC (below business as usual levels) under Phase II, which is consistent with moving towards our long-term 60% carbon reduction goal and illustrates our strong commitment to the Scheme. But we must now work with others to ensure that, across the EU, the Scheme creates clear incentives for early investment in low carbon technologies and continues to drive reductions in carbon emissions at least cost.

1.12 The Government will continue to work with the European Commission and the other EU Member States regarding the direction, ambition and future reinforcement of the EU ETS. Strengthening and reinforcing the Scheme is necessary to provide firms with the long-term certainty they need.

1.13 The Government will also aim to secure agreement to a number of changes to the Scheme which will help to strengthen it post-2012. These include:

1.13.1 **Providing greater clarity on when and how limits (caps) on emissions will be decided in future.** Announcing our long-term intentions for the EU ETS will provide early certainty for investors in low carbon technologies and signal an EU-wide commitment to reducing carbon emissions beyond 2012. We need to signal the direction of EU emissions reductions much further into the future. And we will continue to set our caps in a manner that ensures the UK plays its part in reducing overall EU carbon emissions, consistent with our 60% carbon reduction goal by 2050.

6 Unless revised as a result of the review of the EU ETS Directive, future caps must be consistent with the factors outlined in Annex III of the Directive, which includes Kyoto obligations and the potential to reduce emissions.

1.13.2 **Simplifying and harmonising the Scheme, particularly the way that allowances are allocated**, so that there are clear and strong incentives to invest in low carbon technology, and to prevent distortions to the EU internal market. Across the EU, the methods used to allocate emissions allowances must move towards clearly rewarding clean technology while not creating incentives for industry to increase their emissions in order to gain higher allocations in the future. This will require EU action to:

- rule out updating of baselines for 'grandfathering' (the method used to allocate allowances based on historical emissions);
- use a more standardised allocation methodology across EU sectors through 'benchmarking' (the method used to allocate allowances for emissions based on average emissions by product); and
- move towards more auctioning of allowances.

1.13.3 **Ensuring the market functions more efficiently.** Improving the transparency of information on allocations in advance of trading periods will improve visibility on the fundamentals driving long-term EU allowance prices. Clear, easily accessible information on final allocations – as well as the basis of allocation decisions – should be made freely available to ensure confidence in the EU ETS market.

1.13.4 **Considering whether more sectors – and more greenhouse gases – should be included** in order to maximise opportunities for significant, cost-effective carbon savings. Such consideration should take into account, among other factors, the technical potential to reduce emissions, the costs of abatement, the regulatory burden on industry and the impact on sectors already in the Scheme.

1.13.5 **Thinking globally to develop a more liquid and efficient market.** The Kyoto Protocol has established the international framework for a truly global carbon market. The EU ETS is the largest of several carbon markets worldwide, and already links to Kyoto Mechanisms (JI/CDM – see box 1.1) outside the EU, incentivising significant investment in developing countries. Industries covered by the EU ETS can use credits from the JI and CDM markets to meet their obligations in the EU scheme, although the limits to their usage are set by each EU Member State. The UK is committed to working with international partners to deliver a strengthened international framework for the global carbon market through international agreement at UN level. In the interim, the focus should be on ensuring a consistent, robust approach to the use of credits across the EU in Phase II. Maintaining markets for credits from JI/CDM projects beyond 2012, as well as linking the EU ETS to other carbon markets as they are implemented, will also be crucial to encouraging market investment and confidence, and fostering the development of an efficient global carbon market up to and beyond 2012.

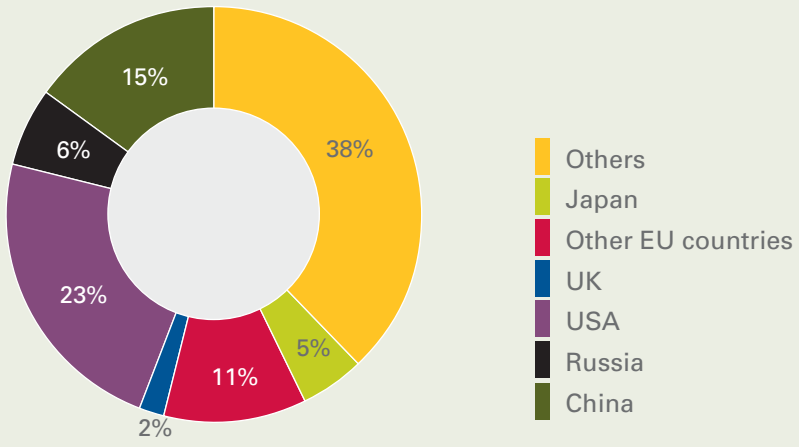
BOX 1.2: TACKLING CLIMATE CHANGE

Climate change is a global problem requiring urgent international collective effort built on a shared understanding of the scale of action needed to stabilise the climate. There must be a shared commitment to take action in response, involving national and local governments, businesses and individuals.

Climate change will only be addressed through both technological development and a robust, inclusive and binding international treaty. For that reason the Prime Minister has said that the international debate must focus on the scale of action needed, and how the international framework needs strengthening to deliver it. Without greater clarity on what we are trying to achieve in the long term, it is very unlikely that the world's short-term efforts will put us on the right path. A long-term goal would send an essential signal to the private sector and others who have a key role in delivering low carbon technologies. Uncertainty leads to delayed or short-term decision-making, and risks negative consequences for competitiveness and security of energy supply.

A clear, disciplined multilateral framework that produces the investment in research and development in science and technology is needed to create a global low carbon economy. The UK, working in partnership with other countries, can play a leading role in assembling this framework, drawing on important lessons learnt in different countries and sectors. The UK cannot act alone – with UK emissions of carbon dioxide comprising only 2% of global carbon dioxide emissions (in 2003), it is imperative that all nations play their part (see chart 3).

CHART 3: GLOBAL EMISSIONS OF CARBON DIOXIDE, 2003



Source: IEA, 2005.

In recognition of the global nature of the problem, the **United Nations Framework Convention on Climate Change (UNFCCC)** was agreed at the Earth Summit in Rio de Janeiro in 1992. To date, 189 countries have ratified it, including all major developed and developing countries. The ultimate aim of the Convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that would avoid dangerous anthropogenic climate change.

The **Kyoto Protocol** (to the UNFCCC), agreed in December 1997, was designed to establish agreed, deeper cuts in emissions needed to prevent serious interference with the climate. Developed countries agreed to reduce their overall emissions of a basket of six greenhouse gases by an average of 5.2% below 1990 levels over the period 2008 – 2012, with differentiated, legally binding targets. The Protocol came into effect on 16th February 2005 and provides the first ever framework for international action with binding targets and timetables for reducing greenhouse gas emissions. With over 150 countries having ratified it, the Protocol represents a very important milestone in tackling climate change.

But the Kyoto Protocol is only the first step, mapping action for the first commitment period (2008 – 2012). At the UN meeting in Montreal in December 2005, all countries agreed to begin discussions on the way forward beyond 2012. It is vital that all major countries are part of a future framework for action, including the US and major developing economies like China, India and Brazil. It was against this background that the Prime Minister put climate change on the international political agenda in 2005 by making it a priority for the UK's Presidencies of the G8 and EU.

The **G8 Gleneagles Plan of Action** aims to increase the speed with which we reduce greenhouse gas emissions. **The Gleneagles Dialogue on Climate Change, Clean Energy and Sustainable Development** aims to provide a forum for continuing discussions amongst the G8, China, India, Brazil, South Africa, Mexico, and other countries with significant energy needs. It enables participating countries to work together to speed up international progress on the shared challenges of addressing climate change, energy security and access to energy. One of the key outcomes from Gleneagles was agreement to establish the Energy Investment Framework led by the World Bank and other international finance institutions to fund investment in clean energy technologies over the next few years. This will be a powerful facility to engage with developing economies, and to incentivise their move towards low carbon technologies.

The EU has played an important leadership role in tackling climate change. The UK is keen to work with EU partners to secure agreement to further action in the EU, in particular strengthening the Emissions Trading Scheme beyond 2012 and making it the heart of a global carbon market. The UK will also work in partnership with the EU to enhance our efforts to help India, China and other developing countries grow their economies on a sustainable, low-carbon path.

BOX 1.2 continued

A sound understanding of the global economic implications of climate change is an essential foundation for an informed international debate about the future. The Stern Review on the Economics of Climate Change, which will report to the Prime Minister and Chancellor in autumn this year, will contribute to this understanding, by setting out how climate change could impact on growth and development, identifying the costs and opportunities from tackling it, and exploring elements of a robust international response.

1.14 The UK will also need to ensure that its work on international climate change is closely aligned with issues relating to security of supply and international energy security. Policy and objectives between these two areas, which together combine to pose the global energy challenge, should be very closely linked.

1.15 It is vital that we progress our priorities for strengthening the EU ETS in a timely manner given the significant investment challenge currently facing the UK electricity generation sector. It is likely that we will need new electricity generation investment equivalent to around one-third of our existing capacity, and given these assets typically have lives of some 20 – 40 years, it is essential that a clear and stable carbon policy framework is in place to incentivise timely and low carbon investment.

1.16 The Government is committed to there being a continuing carbon price signal which investors take into account when making decisions. This is particularly important given the scale of new investment required in UK electricity generation capacity. The EU ETS is here to stay beyond 2012 and will remain the key mechanism for providing this signal. The Government will continue to work with its international partners to strengthen the EU ETS to make it more effective. We will 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 to investors.

Proposals on Valuing Carbon

The Government will aim to secure EU agreement to a number of changes to help strengthen the EU ETS post-2012. These include:

- **Providing greater clarity on when and how caps/limits on emissions will be decided in future;**
- **Simplifying and harmonising the EU ETS, particularly the way that allowances are distributed, so that there are clear and strong incentives to invest in low carbon technology, and to prevent distortions to the EU internal market;**
- **Ensuring the market functions more efficiently;**
- **Considering whether more sectors – and more greenhouse gases – should be included in order to maximise opportunities for significant, cost-effective carbon savings; and**
- **Thinking globally to develop a more liquid and efficient market.**

The Government is committed to there being a continuing carbon price signal which investors take into account when making decisions. The EU ETS will remain the key mechanism for providing this signal. The Government will continue to work with its international partners to strengthen the EU ETS to make it more effective. We will 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 to investors.

CHAPTER 2

Saving Energy

If we are to achieve our goal of a 60% reduction in carbon dioxide emissions by 2050, then we need to look not just at reducing our carbon intensity through low carbon energy sources, such as renewables, but also at saving energy. The challenge is to deliver cuts in emissions in ways that impose least costs on our economy. Up to now, no major country has been able to grow its economy whilst delivering a sustained reduction in energy consumption. But using every unit of energy as efficiently as possible has to be our ultimate ambition. This may even lead to an absolute reduction in energy demand in the longer term. To this end, we are bringing forward ambitious proposals to deliver smarter and more efficient energy services – the heat and light we use in our homes and the power we need for our industries and transport.

The current situation

2.1 Saving energy is key to meeting our long-term energy challenges. It can help us reduce carbon emissions, which is vital if we are to tackle climate change. At the same time, by allowing us to use less energy for the same level of output – whether in industrial productivity or heating our homes – it can contribute to the security of our energy supply, to our economic growth (by lower bills for firms and consumers) and to tackling fuel poverty. Our ultimate ambition must be to use every unit of energy as efficiently as possible while maintaining our prosperity and competitiveness. If we could do this – essentially by wasting less energy – we might need to build fewer power stations in the decades to come than we might otherwise have to do. So energy efficiency is integral to our overall policy.

2.2 We have already put measures in place to promote energy efficiency. By 2010, those measures will reduce the UK's carbon dioxide emissions by over 7% compared to 1990 levels.[7]

2.3 But more needs to be done. Most energy use remains highly inefficient. For example, an average home requires four times as much energy to heat it as the average new home. And on current projections, if we do nothing, energy use and carbon emissions will rise after 2010 (for details see annex C). This is because economic growth is anticipated to increase energy demand; without further action, as current nuclear generation capacity is lost, it may be

7 Action set out in the Energy White Paper, the Energy Efficiency Action Plan and both the 2000 and 2006 Climate Change Programmes, will deliver a reduction in the UK's carbon dioxide emissions of 16% below 1990 levels. 40% of this improvement will be from energy efficiency measures.

replaced by higher-carbon sources; and many energy efficiency policies are currently only committed until 2010/2013. A strong policy framework will be needed for the longer term, and these proposals begin that work.

2.4 We can improve energy efficiency in two ways:

- reducing the amount of energy that we need to support our economy (our energy demand) through technological improvements, for example to the structure of buildings so as to reduce the energy required for heating and cooling or to appliances so they require less energy; and
- changing our behaviour to reduce the amount of energy that we waste.

2.5 Many energy efficiency measures, such as insulating a building or switching to efficient light bulbs, can be cost-effective – meaning that, over the long term, they pay for themselves by reducing energy bills. We estimate that by 2020 businesses and households could save around 25 MtC through cost-effective energy efficiency measures. Policies in the 2006 Climate Change Programme will deliver up to 10 MtC of that by 2010, and another 3 – 5MtC by 2020, but, as technologies develop, further savings could be made across a wide range of sectors. These include: energy-intensive businesses (around 2 MtC by 2020); non-energy intensive businesses (5 MtC); and the domestic (9 MtC) and the public sectors (1 MtC).

2.6 However, although it would deliver cost savings, businesses and households are not making the most of the full potential of energy efficiency. The Energy Efficiency Innovation Review, published in November 2005, summarised the reasons for this:

- lack of appreciation of the true costs and the long-term benefits of energy efficiency measures;
- market misalignment, due to regulatory failures, external budget constraints or split incentives (e.g. the tenant pays the energy bill so the landlord has no incentive to invest); and
- inertia, lack of interest, knowledge or awareness.

2.7 Government needs to respond to different market failures in different ways. In some cases regulatory interventions (e.g. building regulations and appliance standards) can be the most effective and cost effective response. There is also a role for better information (e.g. product labelling), incentives (e.g. the Climate Change Levy and the exemptions from it available through Climate Change Agreements); and market mechanisms (e.g. trading). A package of measures will be the most effective approach.

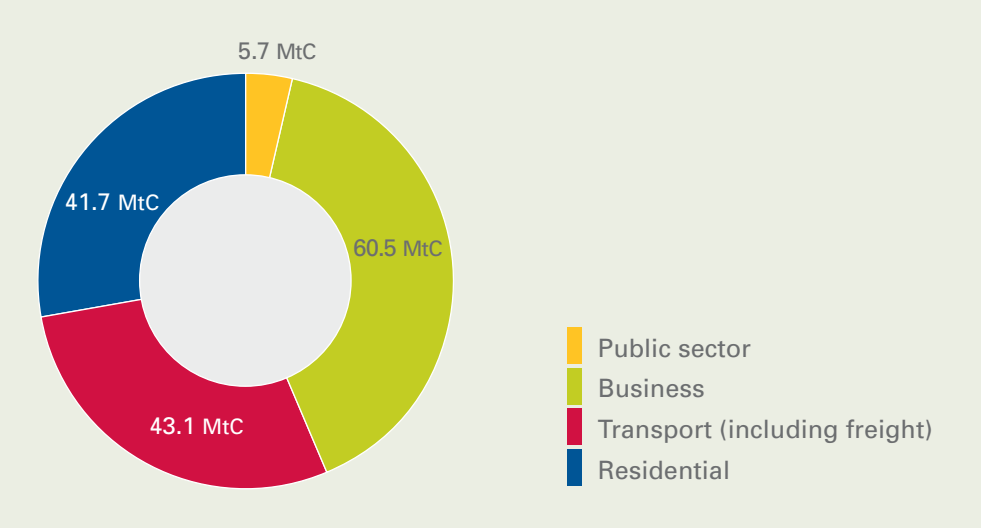
2.8 We consider that we can make the most impact with policies that address the reasons why businesses and households do not make the most of the opportunities to save energy.

Our aspiration

2.9 If we are to increase energy efficiency across the board, all sectors of society will need to play their part. This means creating the conditions for people and organisations to change; demonstrating the benefits (such as saving money, and improving the environment); and making action easier. It also means continuing to support innovation in the technologies for energy use.

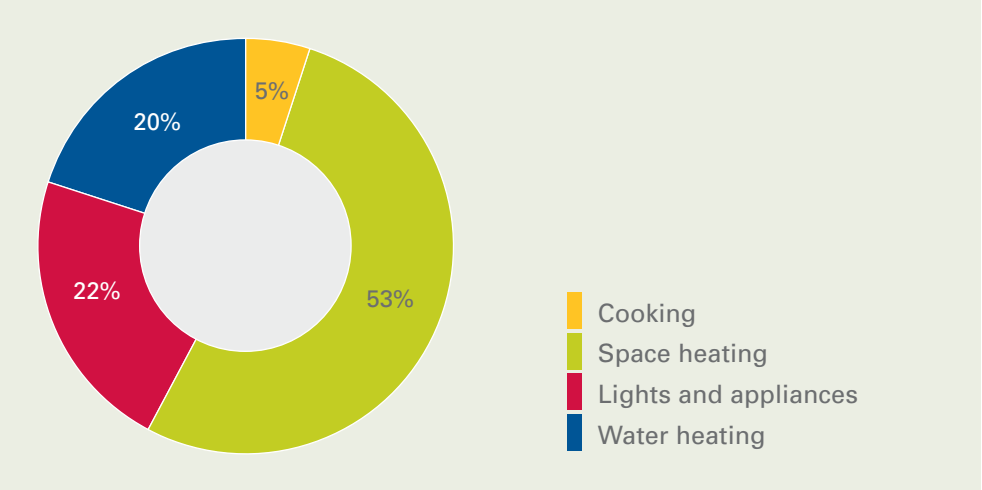
2.10 With the electricity and fuel we use in our homes and our cars, individuals are responsible for nearly half of the UK's energy use and carbon dioxide emissions (see chart 4). In the home, three quarters of the carbon dioxide we emit comes from energy used for heating and hot water and a fifth from lighting and appliances (see chart 5). Making homes – both new homes and the existing housing stock – more energy efficient is key to reducing our carbon dioxide emissions. For Government, this means both ensuring that people and communities have access to more energy efficient homes and equipment, and leading a new push to make thinking about carbon and energy an integral part of the culture. This will involve providing the information, advice, support networks and incentives to support energy efficiency and to change behaviour.

CHART 4. CARBON DIOXIDE EMISSIONS BY END USER IN THE UK, 2004 (MILLION TONNES OF CARBON)



Source: DTI, 2005

CHART 5. RESIDENTIAL CARBON DIOXIDE EMISSIONS, 2003



Source: Defra, The 2006 Climate Change Programme

2.11 The energy market itself has a key role to play. The current market is very much focused on the delivery of units of energy; profits come from increasing sales. We need to ensure that the regulatory and market framework for energy is in line with the objectives of energy saving and reduced emissions, and so stimulate a market for the supply of energy services – warmth, light and power rather than energy per se.

2.12 The Government must lead by example and it has set itself the ambition of delivering carbon neutral central government by 2012. Government, including Local Authorities, as one of the country's largest owners of land and buyers of goods and services, can bring strong purchasing power to bear to drive up energy efficiency standards. Central and local government have the potential to set market standards for goods and services that will become over time the norm for all purchasers.

2.13 The following proposals build on current successful measures and address key gaps and weaknesses identified. They focus on:

- raising energy efficiency standards for new buildings and for the products we buy;
- providing the structure in which a market for energy efficiency services can flourish, to improve the energy performance of existing homes and businesses, and bring forward the new demand side technologies needed to deliver longer-term energy efficiency improvements;
- increasing awareness in all sectors of society and providing the information, advice and support, which stimulate citizens to improve energy efficiency and cut energy waste;
- providing appropriate incentives for each sector of society to take up energy efficiency measures; and
- leading by example.

Raising energy efficiency standards for new buildings and for the products we buy

Carbon neutral developments

2.14 Around 30% of the houses that will be standing in 2050 are yet to be built. So while improving the existing housing stock is very important, it is equally vital to ensure that new houses are built to the highest possible cost-effective energy efficiency standards.

2.15 The Government has made considerable progress on this issue in recent years. Part L of the Building Regulations for England and Wales, which governs energy efficiency, has been repeatedly tightened. The changes introduced in 2002, 2005 (covering new boilers and windows) and April 2006 have collectively delivered a 40% improvement in the energy efficiency standards of new houses.

2.16 But we are determined to go further. As we have recently announced[8], our long-term ambition is to move towards carbon neutral development. This will take time to deliver. But a series of measures – a mixture of regulation, guidance, encouragement, and demonstration – is already in hand to move us significantly towards it. Government is:

2.16.1 Developing the 5 Levels for the Code for Sustainable Homes (CSH). The exact levels will be announced later this year, but we have already indicated that even Level 1 will require energy efficiency performance above the current Part L of Building Regulations. And Level 5 will require that new homes be carbon neutral.

2.16.2 Making clear that the levels should be taken to indicate the long-term direction of Building Regulations. This gives the construction industry a clear steer regarding our long-term intentions in this area.

2.16.3 Reviewing the guidance that accompanies Building Regulations, with a view to simplifying them and improving compliance with them. This is important, as the frequent changes to Part L have been difficult for certain (especially small) builders to keep up with. We need to clarify this guidance, and ensure that all new houses are built to the required standard. This is one of a number of steps we are taking to improve compliance with the Regulations (see box 2.1.).

2.16.4 Requiring all Government-funded new housing in England (such as English Partnerships and Housing Corporation developments) to meet the EcoHomes "Very Good" standard (equivalent to Level 3 of the CSH). Government is leading the way with this measure. It is also helping to develop the necessary skills and capacity in the industry to raise standards for all new houses.

2.16.5 Introducing energy performance certificates, for both new and existing buildings (see section 2.5.8). These will show how energy efficient a house is, and therefore how high the fuel bills are likely to be. They will therefore act as a powerful new indicator for buyers, significantly raising the profile of energy efficiency.

2.16.6 Developing a new Planning Policy Statement (PPS) on Climate Change. Government plans to consult on this later in 2006, and introduce it in 2007. Complementing the CSH, which covers the fabric of new developments, the new PPS will make clear that the location and design of new developments should also promote the reduction of carbon emissions. This will be done through, for example, promoting mixed-use developments and reducing the need to travel. The new PPS will also encourage the use of more sustainable energy sources, including microgeneration, and Combined Heat and Power.

2.16.7 Strongly urging local planning authorities in England to set ambitious policies for the percentage of energy in new developments to come from on-site renewables. PPS 22 gives them the power to do this.

8 In speech by Yvette Cooper, Minister for Housing and Planning, to the Green Alliance, 17/5/06. See: http://www.communities.gov.uk/index.asp?id=1500138

The Housing and Planning Minister made it clear in a statement to Parliament in June 2006 that all English planning authorities should include policies in their development plans that require a percentage of the energy in new developments to come from on-site renewables, wherever viable. We will continue to monitor this situation, with a view to taking further action, if necessary, to ensure that local authorities set appropriate targets in this area.

2.16.8 Consolidating all these measures in a series of demonstration projects. Again, this shows Government leading the way, showing what can be achieved in new developments. These include:

- a demonstration project by English Partnerships, working with local partners, in Northstowe, Cambridgeshire, to create a new settlement of 10,000 homes, which will aim to achieve a 50% reduction on energy use compared with conventional housing;
- English Partnerships (EP) running a second phase of the Design to Manufacture competition, building on the lessons learnt from the £60K house, and pushing the boundaries further. EP is challenging the industry to build low cost, low carbon and zero carbon homes, but this time looking at whole developments rather than individual homes; and
- undertaking a feasibility study into the Thames Gateway becoming a low carbon development area within a decade, and whether and how fast we can move towards zero carbon thereafter.

2.17 With these measures the Government is moving towards our long-term ambition of achieving carbon neutral developments. Obviously, the carbon savings associated will depend on how long reaching that goal takes. But they will ultimately be very significant. There are currently around 170,000 new houses built in England and Wales each year, and each emits around 0.8 tonnes of carbon per year. So if, for example, the goal were reached by 2020, we would save around 0.4 MtC by 2020, and 4 MtC by 2050.

2.18 Scotland has devolved responsibility for improving the energy efficiency standards of new build houses and the Executive is currently carrying out similar work in relation to reviewing building regulations; introducing energy performance certificates for buildings; planning policy, and permitted development rights. As part of this work, it will also consider better guidance and monitoring of compliance with building regulations.

BOX 2.1: ENSURING COMPLIANCE WITH BUILDING REGULATIONS

As noted in Section 2.16.3 above, the Government recognises that ensuring full compliance with Building Regulations – particularly Part L on energy efficiency – is an issue.

We took steps to address this when the new standards for Part L were brought in in April this year. The Government:

- introduced mandatory pressure testing and commissioning for new buildings;
- simplified the approach to showing compliance, and provided much more detail on ways of doing this;
- launched the largest ever training programme for new Building Regulations, including "train the trainer" events, regional road shows, and sending an e-learning pack to every Building Control Surveyor; and
- extended self-certification schemes to reduce burdens on local authorities, and make compliance more likely.

And since then, the Government has gone further. We have:

- taken powers in the recent Climate Change and Sustainable Energy Act 2006 to extend the time period for local authorities to prosecute breaches of energy efficiency standards. This used to be possible only within 6 months of completion of the work. Now authorities can prosecute within 6 months of discovering a breach (provided proceedings begin within 2 years). This is a very significant change;
- used that same Act to mandate a report to Parliament on compliance with Part L standards, to ensure they are given proper scrutiny; and
- worked with the industry to develop 7 Building Control Performance Indicators, of which ensuring compliance is one. These will give building control bodies a framework to monitor and improve their performance in key areas, such as ensuring compliance.

These measures are all in addition to our review of Building Regulations guidance, referred to in section 2.16.3. Together they form a comprehensive package, and demonstrate our ongoing commitment to addressing this issue.

Raising Standards for Energy-Using Products in Our Homes and at Work

2.19 Making the energy-using products in our homes and offices more efficient will help us to cut carbon emissions. The Government will work at international and EU level and with manufacturers and retailers in the UK to remove the least energy efficient products from the market. We will build markets for the best by setting a firm agenda to progressively raise standards. This will stimulate innovation and competition in the supply chain.

2.20 Much of our energy use goes to power appliances in our homes and businesses. For example, electric motors account for two thirds of all business electricity use, driving machinery, pumps, fans etc – which is equivalent to 40% of all the UK's electricity consumption (see chart 6).

Another 25% of the UK's total electricity is used to power lighting and appliances in the home. If we do nothing, this domestic use is predicted to rise by 20% between now and 2020 as new energy using products – such as computers and gaming consoles – become more common-place in the home. If we are to reduce this growth in energy demand we need to find ways to make the products we all buy and use more efficient.

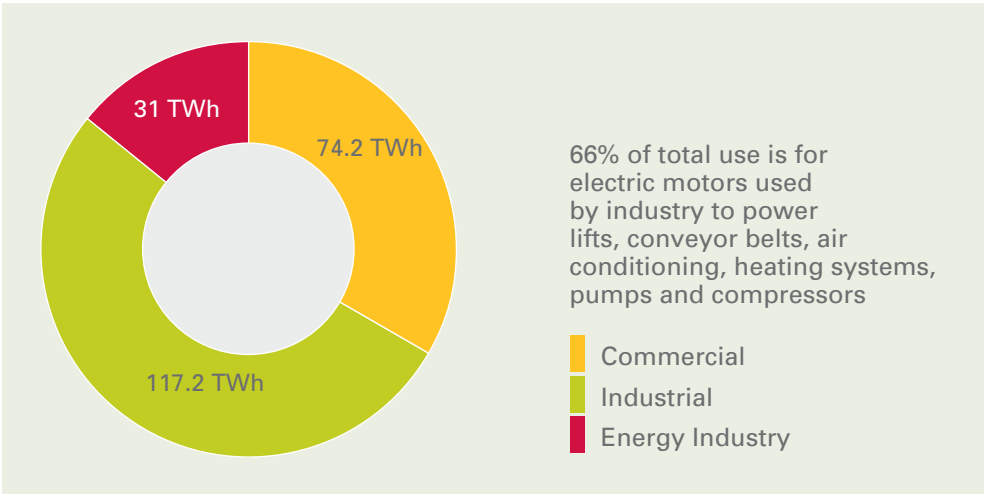
2.21 We use several ways to drive improvements in the energy efficiency of products, including EU legislation, voluntary agreements, labelling schemes, and building standards. The Government's Market Transformation Programme supports this work[9]. This is turn sits within the Government's broader Sustainable Consumption and Production Strategy (see footnote below). Our future policy will build on and strengthen this existing Government action.

2.22 We have identified several groups of products for action:

- domestic lighting;
- consumer electronics such as set top boxes, television sets and chargers;
- white goods such as fridges, freezers and washing machines;
- static electric motors and drives used in machinery such as pumps and fans (as used, for example, in air conditioning systems); and
- office equipment such as computers, printers and photocopiers.

2.23 Aiming to limit stand-by power consumption, which in 2004 used 8% of all residential electricity and is a rising trend, is also a priority for the Market Transformation Programme. We will continue to press at international level for full implementation of the International Energy Agency's 1 Watt initiative to reduce stand-by power consumption.

CHART 6. ELECTRICITY USE BY UK BUSINESSES (FIGURES IN TERAWATT HOURS, 2005)



Source: Defra's Market Transformation Programme

9 The Government's Market Transformation Programme works with industry and other interested parties to drive and underpin sustainable improvements in the energy efficiency and other environmental characteristics of products. (http://www.mtprog.com/). For more information about the Government's Sustainable Consumption and Production Strategy see www.defra.gov.uk/environment/business/SCP/

2.24 We will continue to work at the international, EU and UK levels to stimulate competition in the innovation and supply chain to raise standards through:

- the ranking of products, (e.g. through performance indicators, labels and lists); and
- the setting, publication and implementation of efficiency standards, using all suitable policy instruments.

2.25 Under the new framework directive on the Eco Design of Energy-Using Products (EuP), adopted in 2005, proposals will be brought forward to set standards for 14 products identified as priorities under the EU Climate Change Programme, including consumer electronics, lighting, heating, white goods and electric motors. These standards will apply across the EU and we in the UK will press for ambitious standards to be delivered under this Directive. Furthermore, delivering on our Gleneagles G8 commitment, we will take the lead in promoting international cooperation in setting product standards and in developing global responses to these issues.

2.26 At home, the Retailers' Initiative, announced in Budget 2006, is a key element of our products programme. The Government is working with major retailers and the Energy Saving Trust to introduce voluntary schemes to raise the energy efficiency of the goods they sell. Initially it is expected that these schemes will focus on consumer electronics but they may be expanded to other products.

2.27 The potential for cost-effective carbon savings from this policy are high: if we can raise standards for all the priority products sold in the UK, we can avoid over 1.3 MtC by 2010 and up to 4.7 MtC by 2020.

Providing the structure in which a market for energy efficiency services can flourish

Energy Efficiency Commitment Phase 3

2.28 Demand for energy services in the residential sector is rising by an average of 1.5% per year, equivalent to 0.6 MtC per year. But if the household sector is to contribute to our 2050 goal, energy use would need to fall by around 1.8% per year. This means we need to increase the efficiency of our homes and the lights and appliances we use in them and to reduce the amount of energy that we waste.

2.29 To encourage energy efficiency, Government needs to create the right frameworks and incentives for energy efficiency services – that is, practical assistance and advice helping homeowners and businesses waste less energy and use it more effectively – to flourish.

2.30 The Energy Efficiency Commitment (EEC) is one of the principal policy mechanisms by which we deliver energy efficiency into the home. Under EEC, energy suppliers are required to achieve targets for the promotion of energy efficiency improvements in the household sector in Great Britain. It has been highly successful at doing so and in a very cost-effective way. In the first three-year phase of EEC, which concluded in March 2005, suppliers delivered measures – including loft and cavity wall insulation – which will save

0.4 MtC each year, saving consumers £9 for each £1 spent and reducing consumer bills by £3bn over the period to 2020.

2.31 The second phase of the EEC runs from 2005 – 08. The 2006 Climate Change Programme has already announced that the target for suppliers to promote energy efficiency improvements will be increased by a further 50 – 100% under the third phase, which will run from 2008 – 2011.

2.32 With the passing of the Climate Change and Sustainable Energy Act 2006, the Government needs to consider changes to EEC that could allow all forms of microgeneration and other measures affecting consumer behaviour to be eligible under the Scheme. This would open up EEC, allowing suppliers to offer more options for the delivery of carbon savings, with a larger range of measures and more scope for innovation and competition amongst suppliers to encourage consumers to reduce their energy demand. The Government will therefore be consulting this summer on whether to extend the range of measures allowed under the third phase of EEC.

Supplier obligation to target household emissions

2.33 Government is committed to maintaining a household obligation on suppliers in some form until at least 2020. The level of ambition from 2011 should at least be equal to that under EEC3, delivering a minimum of 3 – 4 MtC by 2020.

2.34 The EEC has been very successful at delivering technical measures such as loft and cavity wall insulation, but it does not address the important issue of consumer behaviour, getting us to reduce waste or think about the energy efficiency of the appliances that we buy.

2.35 The Government therefore wishes to incentivise energy suppliers to engage more actively with customers in order to deliver greater energy efficiency in the home. We want to provide the right stimulus for them to develop new market opportunities to sell energy services, rather than just energy per se, so what the consumer buys are services for heating, lighting and powering their homes, in the most energy efficient way practicable. One way to achieve this, as identified by 2005 Energy Efficiency Innovation Review, could be to move in 2011 to a supplier obligation based on a tradable target set in terms of reducing absolute energy demand or carbon emissions from the household sector. Such an obligation, if introduced in this form, would replace the current Energy Efficiency Commitment once its third phase expires in 2011. It would focus energy suppliers' attention on how to deliver energy efficiency to their customers as a marketable service rather than a regulatory requirement. Our energy companies are willing to go in this direction – to change their whole business model – if we support them through the right policy framework. This is a major shift in thinking.

2.36 In the period up to 2011, we will seek to use the experience gained from EEC3 and the money announced in Budget 2006 for smart meter trials and other innovative measures and to learn whether and how this can best be done. Our long-term ambition is to incentivise a sustained reduction in household demand. We will carry out further analytical work and consultation with interested parties before deciding the final scope and objectives of the post-2011 framework.

Increasing awareness and information in all sectors of society

2.37 Householders are more likely to invest in energy efficiency improvements and to reduce the waste of energy if they are provided with timely, specific and relevant information on their energy use and how much it costs. Combined with the information in Home Information Packs showing where energy efficiency improvements can be made, better and more timely information will help householders make decisions on where and how they can make real savings on their energy bills. This will complement existing work by the Energy Saving Trust and measures set out in the UK Climate Change Programme.

Better energy bills

2.38 The Government proposes that it will mandate, from 2007 onwards, improvements in the information provided in domestic customers' energy bills, requiring bills to provide comparative historic energy use in graphical form (showing a customer how much energy they have used over previous periods), supported by information on energy efficiency.

2.39 Currently, between 25 – 50% of domestic bills supplied by energy suppliers at any one time are estimated. Unless they are using a pre-payment meter, current metering and billing arrangements provide little in the way of incentive for householders to think about how they use energy and the consequences their energy use has on climate change.

2.40 Studies show that consumers respond to the provision of historic information on their energy use in their bills, particularly when it is combined with more frequent and accurate bills[10]. The information also needs to be easy to understand. Consumers surveyed by Ofgem[11] preferred simple bar charts on bills to compare their own energy use with the last quarter or the whole of last year, but disliked benchmarking with 'average' homes. As this latter approach is suggested as being "useful" in the Energy Services Directive, it requires further examination. We will consult with Ofgem, the energy suppliers and interested parties as to what useful comparative benchmarking information can be provided cost-effectively in bills to aid customer awareness.

2.41 At present, energy suppliers are obliged to read meters once every two years. This licence requirement is under consideration in Ofgem's current review of gas and electricity supply licences, and the suppliers are advocating its removal. However, the full benefit of improved billing is realised when customers are provided with frequent, accurate bills. Replacing the existing requirement with a requirement to read meters annually, while also allowing suppliers to meet their obligations with customer self-reads may well improve information available to customers without increasing the regulatory burden on suppliers. We will consult further with Ofgem, the energy suppliers and interested parties on how we can cost-effectively improve the frequency at which customers are provided with accurate bills.

10 Studies report savings of up to 12% per year on energy use.
11 http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/8401_consumer_fdbak_pref.pdf

2.42 We estimate that even if the provision of historic information only delivers modest changes in behaviour, this proposal is highly cost-effective. Even if households only reduce their energy use by 0.25%, this will save 0.08 MtC by 2010 and just under 0.1 MtC by 2020. The proposal would add a one-off cost of 10-20p to a household energy bill in the first year.

2.43 Like the residential sector, most business customers receive a mixture of accurate and estimated bills over the course of a year. A study conducted for the Carbon Trust highlighted that access to timely energy data and the provision of accurate bills are a barrier to energy efficiency management in the business sector. The Government will therefore also consult with interested parties on the provision of information similar to that proposed for households for business customers not currently covered by half-hourly electricity and gas meters.

Real-time displays for households

2.44 The technology is available that can provide householders with direct, instant information on how much energy they are using and how much it costs by transmitting information from the electricity meter to a portable display. A recent study in Canada over a two and a half year period showed that households reduced their energy bills by an average of 6.5%[12].

2.45 Powergen is currently testing a real-time electricity display to determine the extent of energy saving that it can deliver to UK households. The results of this trial should be available in 2007. Other energy suppliers may propose further trials of displays under the trials of smart meters co-funded by Government and the energy suppliers, announced in the 2006 Budget.

2.46 The Government considers that real-time displays provide an effective means for households to check their energy use and can play a key role in helping householders to reduce their energy bills by identifying ways to save energy. Following on from the trials being conducted by Powergen, we intend to discuss with Ofgem, the energy suppliers and interested parties how best to rapidly roll out the provision of real-time displays which provide instant energy consumption and cost information on electricity use.

2.47 Our analysis indicates that such electricity displays will help us realise real carbon and energy benefits if there is a rapid roll out. If we started a 5-year programme to install such devices in households in 2007, we could see a 0.3 MtC saving by 2010, rising to 0.4 MtC by 2020. We estimate that this could add £2 – 6 per year to energy bills over the 5 year period, but would more than pay for itself through energy savings and hence reduced bills.

2.48 Currently there are no commercially available displays that can provide real-time information on gas use. The trials of smart meters, announced in the 2006 Budget, provide a means for meter manufacturers to bring forward such technology and to demonstrate its costs and benefits.

12 A summary of the various studies can be found in: Darby S. (2006) The effectiveness of feedback on energy consumption. A review for Defra of the literature on metering, billing and direct displays.

Smart meters for homes and businesses

2.49 "Smart meters" – that provide instant updates on energy use – and other sophisticated forms of monitoring can provide information that help consumers make more informed choices. The Government considers it should examine the scope for more sophisticated monitoring of energy usage, its costs and benefits through the forthcoming trials of residential smart meters and other forms of feedback about electricity and gas consumption, as announced in the 2006 Budget.

2.50 Smart meters have the potential to deliver many benefits to the energy supplier and the consumer[13]. They allow remote reading, avoiding the need for house calls and so ensuring energy bills are accurate. Smart meters can also be used with variable tariff structures for electricity consumption, for example, to discourage electricity use during peak periods. They can therefore contribute to improved energy security, as some network reinforcement and peak generation capacity could be avoided. Smart meters with an "import-export" facility allow consumers installing micro-generation such as small scale wind, solar (PV) panels or micro-CHP to sell their spare electricity to the grid.

2.51 Purchase and installation costs of smart electricity meters vary from £40 to £180, depending on function. Ofgem have estimated that the total cost of installing and maintaining one-way smart meters could be up to £5 – 8 billion[14]. In comparison, the current cost to gas and electricity customers of installing, reading and maintaining meters is £800 million[15] each year. These costs are estimated against a backdrop of little or no data on the implications of rapid roll-out to the likely costs and benefits of smart meters.

2.52 Our own analysis suggests that the full benefits of smart meters would not be realised unless there was a full roll-out. However, a full-scale smart metering programme could have serious implications for energy prices, potentially increasing annual gas and electricity payments by £20 each for ten years.

2.53 Ofgem recently published their opinion on the role and value of smart metering[16]. They wish to work with industry to remove those barriers that currently inhibit more innovative metering and to encourage inter-operability of meters between different suppliers. They also announced that they would not re-regulate responsibility for metering onto the network operators.

2.54 While smart metering technology is commercially available for the electricity market, further development is required to overcome technical issues for gas metering. The Government expects the metering industry to develop technology for gas customers similar to that already available for electricity, taking advantage of the Government-sponsored trials to test effectiveness.

13 Owen G. & Ward J. (2006) *Smart meters: Commercial, policy and regulatory drivers.* Report published by Sustainability first. http://www.sustainabilityfirst.org.uk/publications.php
14 These costs do not assume any savings from bulk purchase or bulk roll-out.
15 Ofgem(2003) Factsheet 26 "*Introducing competition in metering*". March 2003.
16 Ofgem (2006) "*Domestic Metering Innovation – Next Steps* Ref. 107/06. 30 June 2006.

2.55 Metering trials, co-funded by Government and the energy suppliers, will start this winter, with results available from 2008. They provide the opportunity to explore the wider benefits of smart metering to the UK economy. This includes the value of gas smart meters, where information is currently lacking. Through the trials we can test the effectiveness of smart meters in comparison with cheaper options such as improved billing and real-time displays. There is also the potential to test the value of different tariff structures on peak load shifting and energy reduction.

2.56 More also needs to be done to create a demand from business for smart meters and to raise awareness of energy efficiency.

2.57 The Carbon Trust is conducting a smart metering trial amongst SMEs to promote awareness and build support for smart metering. Early results suggest significant energy savings are possible. Once the results of this trial are available, in late 2006, the Government will be in a position to discuss with relevant parties how to address the barriers to smart metering in the business sector along with ways of improving awareness and information on energy efficiency.

Home Information Packs (HIPs)

2.58 The information available to homeowners about the energy efficiency of their homes will be further improved by the introduction of Home Information Packs (HIPs) in England and Wales, which will include energy performance certificates.

2.59 Under the EU's Energy Performance of Buildings Directive, energy performance certificates will be required for all buildings on change of occupation – such as when they are bought, sold or rented. For existing houses, Government is implementing this requirement by including the certificates in HIPs. They will be rolled out in England and Wales from June 2007. The Scottish Executive is currently considering the implementation and roll-out of this directive within the domestic sector in Scotland.

2.60 As the Government recently announced[17], the certificates will rate the energy efficiency of a house on a scale of A to G. Prepared by qualified home inspectors, they will include information on the current average costs for the heating, hot water and lighting of the house. And, crucially, they will include practical advice on which energy efficiency measures the owner/occupier could carry out to cut carbon emissions from the house and improve its energy efficiency rating.

2.61 The focus will especially be on measures, such as cavity wall insulation, and thicker loft insultion, that will quickly prove cost-effective. But the certificates will also list measures, such as solar panels and wind turbines, which could cut carbon emissions even further. Around 1.5m homes are put up for sale each year, and research shows that the vast majority of home improvements are carried out within 6 months of the purchase of a property. The certificates, therefore, will help to inform and influence the behaviour and spending decisions of up to 1.5m households per year.

17 On 14 June 2006 – see: http://www.communities.gov.uk/index.asp?id=1002882&PressNoticeID=2174

2.62 Energy performance certificates will also be required for non-domestic buildings. And all buildings used by public authorities or institutions, and frequented by the public, will be required to display their certificates, enabling the public to see and compare performance.

Looking at new measures to improve the existing housing stock

2.63 As the measures set out in this chapter make clear, the Government recognises the vital importance of tackling the existing housing stock. 70% of the houses that will be standing in 2050 have already been built, and many of the oldest ones are much less energy efficient than more recent ones.

2.64 So in addition to the energy efficiency measures set out here, the Government will continue its in-depth review of the existing stock, which was announced by the Minister for Housing and Planning in September 2005. It will conclude this work later this year.

Providing incentives for each sector of society

The large non-energy intensive business and public sector

2.65 Government policy to address emissions from business has so far been primarily focused on the energy intensive industries, through their participation in the EU Emissions Trading Scheme and Climate Change Agreements. Corporate leaders[18] have called for the Government to address the gap in its current policy coverage by developing "strong new policy instruments" to "focus on the large, non-energy intensive users of energy in the commercial and public sectors". The Energy Efficiency Innovation Review demonstrated that there are significant opportunities in the large non-energy intensive sectors to improve energy efficiency which are not currently being exploited.

2.66 Government believes that large commercial and public sector organisations have significant potential to achieve cost-effective carbon reductions. These large organisations cover about 15 MtC of emissions and analysis suggests they could cost-effectively save 0.5MtC per year by 2015, rising to 1.2 MtC per year by 2020.

2.67 The Government therefore proposes to consult later in the year on the most effective measures for achieving these reductions.

2.68 Analysis by the Carbon Trust concluded that participation in a mandatory auction-based emissions trading scheme, which targeted energy use related emissions, would incentivise the uptake of energy efficiency measures within the large non-energy intensive sector. Other policy options, which could also achieve energy efficiency improvements, include benchmarks on energy use, and voluntary reporting on emissions.

18 The Corporate Leaders Group have highlighted "that there is a need for further policy action if we are to realise the potential economic and environmental benefits of energy efficiency". The UK Business Council for Sustainable Energy have also pointed to this gap in our energy and climate change policies and called for "strong new policy instruments" to "focus on the large, non-energy intensive users of energy in the commercial and public sectors".

2.69 The consultation will therefore put forward a proposal for a mandatory emissions trading scheme, alongside other options for achieving our carbon reduction aims in this sector, and will invite views.

2.70 In order minimise administrative burden, the Government's proposal for such a trading scheme (or Energy Performance Commitment) will target emissions from energy use only by large organisations whose electricity consumption is greater than 3,000mWh/yr[19] and which are not included in the EU ETS and Climate Change Agreements. This would involve some 5,000 organisations in total, comprising sectors such as supermarket chains, hotel chains, government departments and large local authorities. Auction revenues would be recycled to participants.

Climate Change Agreements

2.71 The UK business and public sector is subject to a tax on their energy use – the Climate Change Levy – designed to incentivise industry and the public sector to reduce their demand for energy. In order to protect the competitiveness of the most energy-intensive sectors of industry, Climate Change Agreements (CCAs) were introduced as part of the Climate Change Levy package. Under these agreements, participating industries receive an 80% discount from the climate change levy, provided that they enter into agreements to meet energy efficiency targets or reduce their carbon emissions.

2.72 CCAs currently run until 31 March 2013. The final target period is 2010, and facilities that meet this target will be eligible to continue to pay the reduced rate of the Climate Change Levy until 31 March 2013. State aid approval for the CCAs was, unusually, granted for ten years up to 31 March 2011, because of the need for long-term stability for industry to plan for and invest in energy efficiency measures. A further state aid notification will therefore be required to cover the final two years of the current agreements and any extension of the agreements beyond 2013.

2.73 CCAs have successfully delivered substantial carbon savings in their first five years and are expected to continue to perform well. There are over 6,000 companies, covering over 14,000 sites in 54 sectors, now covered by agreements, with new applicants continuing to come forward.

2.74 In order to underpin achievements to date, Government will consider, in good time before the expiry of the current agreements, the future of CCAs and how we can take the objectives forward.

Leading by example

Carbon neutral government

2.75 The Government has announced its intention that, by 2012, the Government office estate will be carbon neutral. As part of this commitment we have set an aspirational target to reduce carbon emissions from central Government buildings by 30% by 2020. The Government has already introduced carbon offsetting for official air travel.

19 An analysis of this proposal can be found at:
www.defra.gov.uk/environment/climatechange/trading/uk/pdf/nera-enviros-report-060428.pdf

2.76 This measure will save approximately 0.8MtC per year and is designed to deliver a significant improvement in the way the Government manages its land and buildings sustainably.

London

2.77 Over the last year, we have been reviewing the powers of the Greater London Authority (GLA). As part of this review we have looked at a possible strategic role for the Mayor on energy and climate change in London. We propose a new statutory duty on the GLA to take action to mitigate the effects of climate change and adapt to its unavoidable impacts. The Mayor will publish a Climate Change and Energy Strategy setting out his plans for mimimising emissions of carbon dioxide caused by the use of energy in the capital, helping eradicate fuel poverty and harnessing the economic opportunities for London from investment and innovation in energy technologies and energy efficiency. He will also publish a Climate Change Adaptation Strategy setting out how the capital should adapt to the effects of climate change.

Local authorities

2.78 It is important that local authorities take action to combat climate change, in a cost effective way, taking account of local circumstances and priorities. Our proposals to provide a real incentive for local authorities to take action on climate change will be set out in the Local Government White Paper this autumn.

2.79 In Wales, all local authorities have signed a declaration on climate change committing them to producing a climate change action plan. Energy efficiency will be a critical area of importance in the development and implementation of these plans.

Local and community action

2.80 If we are to be successful in delivering the long-term cuts in carbon emissions that we need to avert dangerous climate change, the involvement of individuals will be critical. There are many barriers to individual engagement, but we anticipate that local authorities and community groups can play a key facilitating role. Research, such as that undertaken by Futerra for Government in 2005 (available on the DEFRA website), has shown that engagement at a local and community level is important. This is because attitudes to climate change are more likely to be changed through individual interaction and because climate change messages need to have local relevance to appeal to people.

2.81 It is for this reason that Defra launched its Climate Change Communications Initiative last year, aimed in large part at local and community level initiatives. This year, under the Climate Challenge Fund, we have already approved £4.8m worth of projects designed to raise awareness about and change attitudes towards tackling climate change. Examples of organisations that will receive funding include the Scouts, who will be encouraging members to 'Be Prepared for the Future', and the Women's Institute who will develop EcoTeams to help bring home the realities of climate change.

2.82 The 2006 Climate Change Programme stressed the importance of local and regional government in delivering emissions reductions, both as

community leaders and through their own estates and operations. It set out a package of measures to encourage action by local authorities. There is already excellent practice in some local authorities and the Government supports the work of the Energy Saving Trust and the Carbon Trust in disseminating and encouraging good practice.

2.83 But we recognise that individuals identify with different communities – some may look towards their local authority, parish councils or neighbourhood group; others may feel closer to clubs, societies, faith groups or other interest groups. We want to understand these links and the opportunities they present to overcome barriers to individuals taking action personally to combat climate change.

2.84 Over the next 12 months, DCLG, Defra, DTI and HM Treasury will undertake a joint study which will look at the role of 'community level' approaches to mobilising individuals, and the role of local authorities in particular in making them work effectively. It will draw on experience of what initiatives have worked and which haven't in both the environmental area and other policy areas, such as public health. In the light of this information, the study will also examine what new policy options, such as tradable personal carbon allowances (PCA), could be deployed to stimulate local action and consider their relative pros and cons. We expect it to report to Ministers in the first half of 2007.

Government procurement

2.85 We intend to save energy across the Government estate and to use the power of Government procurement to get better value for money through competition to provide more efficient and sustainable buildings, goods and services.

2.86 The Government buys goods, services and capital assets to provide better public services and how it does so can make a big difference, both to the achievement of its sustainable operational targets and to its external credibility.

2.87 The Government will play its part in reducing its energy demand by developing and implementing, for central Government departments, mandatory energy efficiency and sustainability standards for the goods and services we procure. We will also encourage their adoption more widely in public procurement.

2.88 These standards will apply to services which directly affect carbon emissions from the Government estate, wherever cost-effective – for example, services for the lighting and heating of its building and for IT.

2.89 In practical terms this means we will:

- Set and periodically raise ambitious energy efficiency standards for Government procurement of goods and services, adopting global best procurement standards for energy use wherever cost-effective;
- Extend, publish and maintain a list of forward-looking Government sustainable product standards (currently the 'Quick Wins' and other procurement guidance) to encourage market innovation and stimulate

competition amongst suppliers to bring forward improved buildings, goods and services that are good value for money; and
- Establish a clear framework of accountability and capacity to deliver within Government sustainable procurement.

2.90 The Sustainable Procurement Task Force (SPTF) published its National Action Plan on 12 June 2006. The Action Plan set out 6 recommendations in order for the UK to become amongst the leaders in the EU by 2009 (as we committed to the Sustainable Development Strategy 2005) and it identified 10 public sector procurement priorities for Government of which one was energy. It estimated that the total value of public sector procurement was £150bn. The public sector accounts for a greater proportion of sales for the growing environmental industries sector, currently worth some £25bn, than any other single UK customer.

2.91 The Government will give a full response to the report in the autumn.

2.92 The Office of Government Commerce estimates that Government can reduce energy use by 10% through behavioural change to reduce waste and a further 5% through use of more energy efficient products and services. It is currently developing a cross-government collaborative approach to deliver more effective procurement and use of energy within the Government Estate, focusing on cost reduction through better procurement, energy management and consumption reduction. The work will begin delivering in 2007.

2.93 As an example, we estimate that, if central Government procures only products meeting current best practice in energy efficiency, it could cost-effectively save about 40,000 tonnes of carbon per year from its use of IT equipment and lighting. More important will be the demonstration effect to business; the leverage effect of UK Government procurement power; and the dynamic effects on producers through the forward commitment – which will encourage the market to develop better performing products.

Fuel poverty

Energy Efficiency measures can help consumers cut their electricity and gas bills. They can be one of the ways to help tackle the problem of fuel poverty, and ensure that the most vulnerable consumers can afford to heat their home to an adequate standard.

2.94 Everyone should be able to afford an adequate energy supply and to live in a warm home. This social aspect of energy has driven policy since 1997. The number of households having to spend disproportionate amounts of their income on fuel bills has declined.

2.95 Fuel poverty is defined as the need to spend more than 10% of income on fuel to maintain a satisfactory heating regime. Between 1996 and 2003, the number of vulnerable households in fuel poverty fell from around 5 million to around 1.5 million across the UK. Strategies to end fuel poverty depend ultimately on improving housing standards and rising incomes, policies that have been given priority.

2.96 One of the key background reasons for the reduction is a stable economy with high employment and income growth. The UK economy is currently experiencing its longest unbroken economic expansion since quarterly records began, with GDP now having grown for 55 consecutive quarters. The economy has generated 2.4 million additional jobs since 1997.

2.97 In addition to a stable economy, good progress has been made on tackling poverty in vulnerable elderly households and households with children. Since 1997, pensioner poverty has fallen by over two thirds in absolute terms, lifting 2.1 million older people out of absolute low income and around 1 million pensioners out of relative low income. A single pensioner is now guaranteed a minimum weekly income of £114.05 compared to just £69 in 1997. Additionally, the Winter Fuel Payment is a significant, well-timed payment, which reassures older people about keeping their homes warm in winter.

2.98 For households with children, recent data shows that between 1998/99 and 2004/05, the number of children in relative low income households fell from 3.1 million to 2.4 million on a before housing cost basis. As a result of reforms, by April 2006 families are on average £1,500 a year better off than they were in 1997.

2.99 The Government has put in place a range of specific fuel poverty policies that are having an increasing impact. Thanks to Warm Front and its equivalents in the Devolved Administrations – Scotland's Warm Deal and Central Heating Programme, Wales' Home Energy Efficiency Scheme and Northern Ireland's Warm Home Scheme – some 1.5 million homes have been helped. Other policies helping to tackle fuel poverty include the Energy Efficiency Commitment, with a proportion of measures directed towards a priority group of low income customers, and the Decent Homes Standard in England, through its requirement that, for a home to be decent, there must be a certain level of thermal comfort. As a result of energy efficiency measures provided through the first phase of EEC (2002-05), low income households are now benefiting by some £127m a year. By helping to improve the energy efficiency of fuel poor households these schemes improve their quality of life.

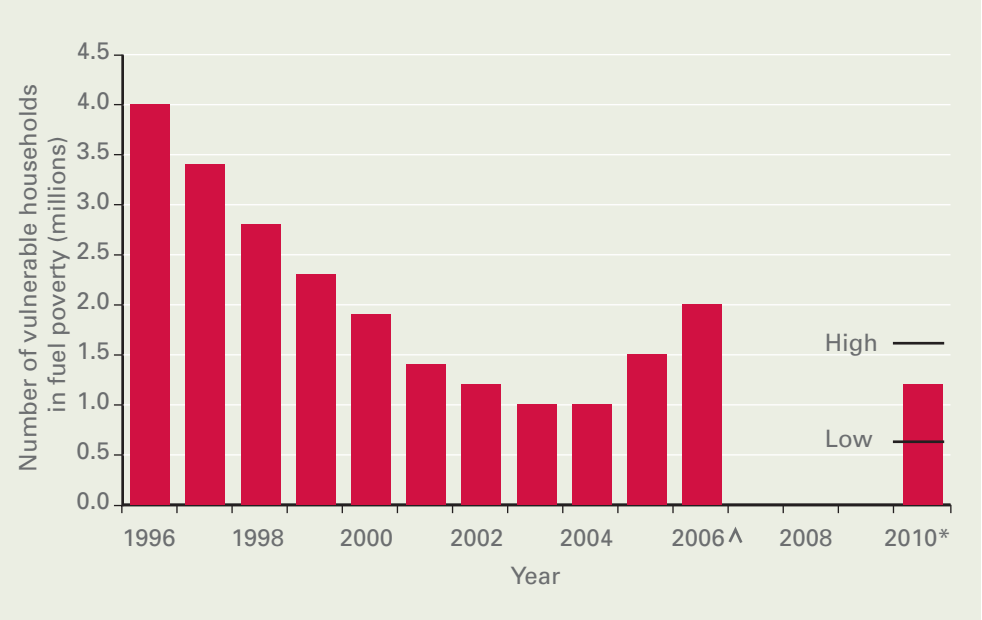
2.100 The effectiveness of all schemes is examined periodically, and changes are made to improve their impact. There is an increasing role for Benefit Entitlement Checks in fuel poverty programmes, which both increase household income and establish eligibility for assistance.

2.101 Other bodies also help to tackle fuel poverty. These range from charities such as National Energy Action and the National Right to Fuel Campaign, who carry out valuable research into best practice in tackling fuel poverty, to Ofgem and energywatch in their work encouraging best practice and making sure the market works for vulnerable customers. Energy suppliers also pursue a variety of actions to help their most vulnerable customers, including measures such as the Home Heat Helpline which provides vulnerable customers and their representatives with a central point of information relating to the range of help available from their supplier and others.

2.102 Rising energy prices will now, however, reverse the downward trend in fuel poverty. Figures for 2004 showed that fuel poverty remained broadly unchanged relative to 2003, with analysis suggesting that the total number of vulnerable households in fuel poverty is likely to rise by around one million households in England between 2004 and 2006. In the latter part of the decade, fuel poverty is forecast to fall, as energy prices stabilise and incomes continue to grow, but there are still likely (on this central price scenario) to be over a million vulnerable households in England in fuel poverty, excluding consideration of energy efficiency measures available under our main programmes (see chart 7).

2.103 This new trend poses a particular challenge. Government has already acted to start to meet the challenge of rising energy prices on achievement of the fuel poverty targets. An additional £300m has been made available to UK fuel poverty programmes over the period 2005 – 08. This additional funding takes fuel poverty funding in England alone in 2005 – 08 to over £800m. Government has also pledged to continue Winter Fuel Payments for the length of this Parliament. Measures such as this, the Pension Credit and the Child Tax Credit, continue to improve the incomes of vulnerable and low-income households.

CHART 7. HISTORIC AND PROJECTED NUMBERS OF VULNERABLE HOUSEHOLDS IN FUEL POVERTY IN ENGLAND AFTER ECONOMIC EFFECTS (MILLIONS)



^ Positions in 2005 and 2006 are based on the modelling of the impact of income and energy prices movements on the number of vulnerable households in fuel poverty.

* Position in 2010 is based on modelling and shows central price scenario as the main bar, with lines indicating the level of fuel poverty under the low and high price scenarios. These are based on an oil price in 2010 of US $40/barrel (bbl) under the central case, $20/barrel under the low case and $67/barrel under the high case.

Source: DTI, 2006

Fuel poverty within the Energy Review

2.104 It is clear though that further action is needed to tackle fuel poverty. We need to ensure that:

- we get details of the help that is available to those who need it most;
- we explore further ways to reduce a household's energy bills via energy efficiency measures;
- the energy a household consumes is competitively priced; and
- households who are eligible for benefits are claiming them.

2.105 Looking ahead, we will be taking forward work in each of these areas.

Immediate action

2.106 In conjunction with the Devolved Administrations, we will step up our efforts at getting the wide range of existing assistance to those most vulnerable to the effects of fuel poverty. We have been looking at the data sources to identify a simply defined group. Those on (or eligible for and then ultimately in receipt of) Pension Credit aged over 70 are the group we have identified to target. Overall, around a fifth of this group were fuel poor in 2004, compared with 6% of the population as a whole, giving an improved chance of someone helped being in fuel poverty. This group covers over a quarter of the fuel poor in 2004. We will, as a priority, work with industry to get measures to this group.

2.107 We need to use effective communication methods to ensure these households come forward. We will continue to work with a wide variety of partners such as DWP, where we can learn from the experience of the Local Pension Service, which in the period ending March 2006 has made over one million face-to-face visits, and has established joint teams with local authorities in 96 areas, the 'Warm Front Scheme', energy suppliers; and voluntary organisations to maximise our reach. We will develop a strategy to ensure assistance is given to as many of these households as soon as possible.

2.108 In this work it is important that Government and those who provide measures, advice and support work together to ensure vulnerable customers are helped and resources are not wasted in duplicating activity. We need to build on experience such as the Warm Zones initiative, an area-based approach that enables a systematic identification of vulnerable households and a co-ordinated delivery of necessary improvement and related services.

2.109 Once a household has come forward, we will do all we can within the current schemes to take that household out of fuel poverty. This can include a benefit entitlement check to ascertain eligibility to Pension Credit and other benefits, the available measures and referral to energywatch products that will make choosing the most appropriate tariff more straightforward.

2.110 We recognise that older households in receipt of Pension Credit are not the only group suffering from fuel poverty. We will consider rolling out this approach to further identified vulnerable groups after this winter.

2.111 For some households the challenge is in the availability of energy efficiency measures to tackle fuel poverty. The development of new technologies has the potential to help tackle the legacy of cold homes. We will explore the scope for using some of the money already available for the Low Carbon Building Programme to install new technologies (including biomass and heat pumps) to bring renewable sources of energy to elderly households and others in cold homes. In Scotland, the Scottish Executive has recently announced a pilot scheme to test the use a combination of domestic-scale renewable technologies to tackle fuel poverty.

Longer-term actions

2.112 Under the Energy Efficiency Commitment (EEC) at least half of all energy savings are currently directed at a 'Priority Group' of low income customers. The scheme has been highly successful at delivering energy efficiency measures in a very cost effective way. In the first three-year phase of EEC, which concluded in March 2005, suppliers exceeded their targets, delivering measures that will save 0.4 MtC per annum.

2.113 We are currently considering changes to EEC over the period 2008 – 11, and as part of this will consider how the scheme's social objectives should be met in future. The exact details of EEC from 2008 will be subject to an initial consultation this summer, followed by a Statutory Consultation next spring.

2.114 Through EEC and other measures, energy suppliers play an important role in mitigating the impact of high energy prices on the most vulnerable in society. Building on the companies' recognition of their responsibilities in this field the Government now wishes to work with them and other key players to examine how the continuing challenge of fuel poverty can be best addressed.

Conclusion

2.115 The measures outlined above will have a positive effect on the lives of some of those most vulnerable to the effect of cold, damp homes. However there are still a range of issues that need to be addressed.

2.116 Beyond the immediate actions being put forward, further progress towards the Government's fuel poverty targets will depend on measures to increase the incomes of the fuel poor or to reduce their bills. The Government will continue to monitor the impacts of various factors on the vulnerable fuel poor and examine the effectiveness of current measures.

2.117 In dialogue with the energy companies and other interested parties we will continue to keep the policy framework under active review.

Summary of Energy Saving proposals

- **The Government will move towards its long-term ambition of carbon neutral development in England and Wales by:**
  - **i) setting stretching energy efficiency levels for the Code for Sustainable Homes;**
  - **ii) making clear that these will govern the future direction of Building Regulations;**
  - **iii) reviewing the Building Regulations guidance to improve compliance with them;**
  - **iv) requiring all government-funded housing to meet at least Level 3 of the Code for Sustainable Homes;**
  - **v) introducing energy performance certificates for new and existing houses;**
  - **vi) developing a new Planning Policy Statement on Climate Change; and**
  - **vii) strongly urging English planning authorities to set ambitious policies on renewable energy.**

- **The Government will work at international and EU level and with manufacturers and retailers in the UK to remove the least energy efficient products from the market and to build markets for the best of them by setting a firm agenda to raise standards progressively, so stimulating innovation and competition in the supply chain.**
- **We will launch a statutory consultation next spring on phase 3 of the Energy Efficiency Commitment. Prior to this we will hold an informal consultation this summer to explore whether we can extend the range of measures allowed under EEC.**
- **The Government is committed to maintaining a household obligation on suppliers in some form until at least 2020. We will do further work on the option of moving after 2011 to a supplier obligation based on tradable targets or caps for household energy demand or carbon emissions.**
- **The Government proposes that it will mandate, from 2007 onwards, improvements in the information provided in domestic customers' energy bills, requiring bills to provide comparative historic energy use, supported by information on energy efficiency.**
- **We will consult with interested parties on what further useful comparative benchmarking information can be provided and how we can cost-effectively improve the frequency at which customers are provided with accurate bills.**
- **We intend to discuss with Ofgem, the energy suppliers and interested organisations on how best to roll-out rapidly the provision of real-time displays which provide instant energy consumption and cost information on electricity use.**
- **The Government will examine the scope for more sophisticated monitoring of energy usage, and its costs and benefits, through the forthcoming trials of domestic smart meters and other forms of feedback about electricity and gas consumption.**
- **The Government will also work with interested parties to address the barriers to improved metering and billing in the business sector, including the possibility of introducing smart metering.**

- **The Government proposes to consult later this year on the introduction of a new measure for the large non-energy intensive organisations which lie outside the EU ETS and Climate Change Agreements.**
- **The Government will consider, in good time before the expiry of the current agreements, the future of the Climate Change Agreements and how we can take the objectives forward.**
- **The Government will play its part in reducing its energy demand by developing and implementing, for central government departments, mandatory energy efficiency and sustainability procurement standards and will encourage their adoption more widely in public procurement.**
- **Beyond the immediate actions being put forward, further progress towards the Government's fuel poverty targets will depend on measures to increase the incomes of the fuel poor or to reduce their bills. The Government will continue to monitor the impacts of various factors on the vulnerable fuel poor and examine the effectiveness of current measures.**
- **In dialogue with the energy companies and other interested parties, we will continue to keep the policy framework under active review.**

CHAPTER 3

Distributed Energy

Generating energy near where we use it – "distributed energy" – can potentially lower emissions, increase the diversity of our energy supply and, in some cases, lower costs. We will look at the potential of distributed energy as a long-term alternative or supplement to our current highly centralised system. At the same time, we will take steps to encourage the use of low carbon and distributed technologies by individuals and communities, to increase awareness of their potential and to remove barriers to their adoption.

What is distributed energy?

3.1 The UK energy system is highly centralised. Most of our electricity is generated in large power stations connected to a high-voltage 'transmission' network and transported to regional low-voltage 'distribution' networks for distribution to points of use. More than two thirds of our heat comes from gas that is fed through a nationwide gas grid. Both our electricity distribution and gas networks are optimised for a one-way flow, from a small number of entry points out to industry and buildings.

3.2 But there are a number of ways of producing heat and/or electricity for a home, housing development, industrial site or local community, and of connecting these sites through small-scale electricity or heat networks. 'Distributed energy' is a broad term used to denote this diverse range of technologies. Its essence lies in generating energy near where it is used (see box 3.1).

BOX 3.1: DISTRIBUTED ENERGY

There were differences in the way the term 'distributed energy' was understood in submissions to the Review. For some it related solely to energy used near where it was generated. In this report we take a broader view, using the term to refer to the wide range of technologies that do not rely on the high-voltage electricity transmission network or the gas grid. This includes:

- Distributed electricity generation, including:
  - All plant connected to a distribution network rather than the transmission network;
  - Small-scale plant that supplies electricity to a building, industrial site or community, potentially selling surplus electricity back into a distribution network; and
  - 'Microgeneration', ie small installations of solar panels, wind turbines or biomass/waste burners that supply one building or small community, again potentially selling any surplus; and
- Combined Heat and Power (CHP) plants, including:
  - Large CHP plants (where the electricity output feeds into the transmission network but the heat is used locally);
  - Building or community level CHP plants;
  - 'Micro-CHP' plants that effectively replace domestic boilers, generating both electricity and heat for the home; and
- Non-gas heat sources such as biomass, wood, solar thermal panels, geothermal energy or heat pumps, where the heat is used in just one household or is piped to a number of users in a building or community.

3.3 A 'distributed' system could fundamentally change the way we meet our energy needs, contributing to emissions reduction, the reliability of our energy supplies and potentially to more competitive energy markets. The main advantage of the traditional system has been its ability to reduce costs through economies of scale. Gas in large quantities or electricity made in large power stations has been cheaper than other alternatives, despite the cost of transmission over long distances. But a combination of new and existing technologies are opening up the possibility of accessing benefits at a regional or local level.

3.4 New information and communication technologies can help us to monitor and control the electricity system in more sophisticated ways. Emerging energy storage equipment will help us to manage electricity flows on a local scale – most balancing of supply and demand for electricity is currently done centrally. And mass adoption of small-scale generating technologies (for both heat and electricity) would bring down their prices. The result could be economic benefits achieved at a local level rather than through a centralised system.

3.5 There are many advantages to generating energy locally. Chief among them is the potential for more efficient use of our fuels. When using oil, coal, gas or biomass/waste to make electricity, we can use existing Combined Heat and Power (CHP) technology to capture the heat generated and to use it locall.[20] The closer our power stations are to the users of heat, the more we can deploy CHP, reducing the need for an additional heat supply. Given our increasing need to rely on gas for heat, this is potentially a significant benefit in terms of both carbon reduction and reliability of supply. Further efficiencies lie in reducing the amount of energy we lose in transmission and distribution across large distances.

3.6 Another benefit of distributed generation is that small-scale renewable technologies can be deployed at a local level. There is also evidence that a more community-based energy system might lead to a greater awareness of energy issues, engaging people in the supply of energy and, in turn, prompting them to consider how to use it more efficiently. Energy Review submissions outlined a number of other proven and potential benefits of distributed energy applications, for example in providing back-up energy supply, reducing energy costs in some circumstances, and reducing the need to invest in transmission networks.

3.7 Perhaps the most innovative demonstration of the potential of distributed energy has been by Woking Borough Council, which achieved cuts of 77% in carbon dioxide emissions from energy efficiency savings in its own buildings over the period 1991-2004 and invested the profits in renewable energy projects, installing 10% of the UK's solar PV capacity and the UK's only fuel cell CHP by 2004. Among other achievements, Woking Council has developed a network of over 60 local generators, including Combined Heat and Power plant, to power, heat and cool municipal buildings and social housing. Many town centre businesses are also connected to this local energy supply.

Why do we not have more distributed energy?

3.8 Despite the progress made in Woking and in other local areas such as Kirklees in West Yorkshire (see Box 3.2), distributed energy accounts for only a small proportion of our total energy supply. Renewable electricity and Combined Heat and Power plants connected to the distribution grid make up well under 10% of our electricity generation. Off-grid heat generation represents less than 10% of our heat market.[21] Of these, technologies that bring energy generation down to a community or household level – such as the small-scale heat and electricity installations and community heat and electricity networks used in Woking – represent around 1 – 2%.

20 It is not possible to capture the heat from renewables such as micro-wind turbines or solar photovoltaics.
21 'Off grid' here used to refer to heat generation that does not depend on either the gas grid or on electricity.

BOX 3.2: KIRKLEES COUNCIL

Kirklees Council in West Yorkshire has long been a leader on environmental and sustainability issues. It has developed a district-wide renewable energy strategy, established a solar thermal promotion scheme and a corporate capital grant fund for renewable energy. 79 energy efficient homes have been created where owners have invested in solar electricity panels or micro wind turbines. Kirklees now accounts for nearly 5% of the UK's installed capacity of solar photovoltaics across schools, homes and civic buildings. They have also fitted over 160 houses with solar thermal heating and supported a 15kW wind turbine on a local sports college.

3.9 The reasons for current low levels of distributed generation vary by technology and are examined separately below. Three barriers are, to differing degrees, common across them. One is lack of information and awareness. The positive examples of Woking, Kirklees and elsewhere suggest that other developers and planning authorities may be missing cost-effective opportunities to invest in and promote community level electricity networks, CHP, microgeneration and alternative heat technologies. The Government's recent Microgeneration Strategy[21] identified lack of awareness as a key obstacle to the take-up of microgeneration by households, as did our response to the the report of the Biomass Task Force in the context of using biomass for both electricity and heat.[23]

3.10 There are also a number of potential practical barriers. For example, planning permission is often required for installation of microgeneration in a home. The processes required for small electricity generators to receive payment for electricity sold back to the grid, or to access the potential financial benefits of the Renewables Obligation,[24] are complex and time-consuming; and there are currently a number of factors that might be making it more difficult than is necessary to develop local private wire electricity networks.[25]

3.11 Finally, most types of low-carbon distributed generation, especially microgeneration of electricity, are currently expensive compared to more conventional technologies in most circumstances, with high upfront investment costs. But the cost of the best new technologies should decline over time if there is a receptive market and a fair chance to compete. We need to be doing all we can to ensure that we are not missing cost-effective current opportunities, and that we are providing the context in which new technologies can take hold, build scale and become competitive over time.

22 http://www.dti.gov.uk/energy/sources/sustainable/microgeneration/strategy/page27594.html
23 http://www.dti.gov.uk/energy/sources/renewables/renewables-explained/biomass/government-response/page28196.html
24 The Renewables Obligation is described in the Renewables section.
25 Private wire networks are stand-alone networks, some of which are capable of operating without connection to the grid. The main private wire networks are in specific applications such as at the UK's largest airports and on the London Underground system. Electricity is created specifically to provide electricity for users connected to the private wire network. Surplus electricity not used on the private network can in the case of some private wire networks, be sold back into the local grid.

Incentivising Action at the Regional, Local, and Community Levels

3.12 It is inherent in the nature of distributed energy that community leadership will have a significant role to play. In his submission to the Energy Review, the Mayor of London outlined a range of actions that will be taken forward as part of London's Climate Change and Energy strategy. Other regional bodies, and some local authorities, including Aberdeen, Leicester, Sheffield and Southampton, have plans to move forward on distributed generation. Merton Borough Council was among the first of a growing number of Local Authorities to set a target for 10% of the energy on new developments in its area to come from on-site renewables.

3.13 Not all communities will have the same potential, because of differences in geography, population density and wealth. It is imperative, however, that we make the most of opportunities to act cost-effectively where they exist. We will introduce therefore a series of measures aimed to promote the growth of distributed generation at community level.

3.14 First, the Mayor of London has already launched a series of initiatives in the area of distributed generation. But as noted in Chapter 2, we will shortly announce a new statutory duty on the GLA on climate change. Among other things, the Mayor will be required to produce a Climate Change and Energy Strategy which will put forward plans to minimise carbon emissions from the use of energy in London. This should give a further boost to the growth of distributed generation in the capital.

3.15 Second, the Housing and Planning Minister made it clear in a strong statement to Parliament in June 2006 that all planning authorities should include policies in their development plans that require a percentage of energy in new developments to come from on-site renewables, wherever viable.

3.16 Third, we will set out proposals that provide a framework to encourage all local authorities to take action on climate change in the Local Government White Paper later this year. It is important that all local authorities take action to combat climate change in a cost-effective way, taking account of local circumstances and priorities.

3.17 Finally, we explained in Chapter 2 that we will be consulting on a range of options to improve energy efficiency in the large commercial sector including the option of a mandatory emissions trading scheme. This consultation will also consider whether larger Local Authorities and public bodies should be included in these measures[26]. If so, this will provide a direct incentive on those bodies to invest in low carbon measures.

3.18 In addition to action at the level of local government, we are also taking forward a series of measures that will promote demand for distributed generation technologies from households and developers. A process to remove the obstacles to installing microgeneration on existing buildings is already in place (see section 3.36). But the majority of the growth of

26 Any new burden on local authorities will be funded as agreed under the existing new burdens agreement.

renewable generation and community electricity and heating schemes will come from new build where renewables such as photovoltaics and microwind, as well as associated infrastructure such as heating pipes and electricity wires, can be built into the building fabric. But a process to remove the obstacles to installing microgeneration is already in place. See section 3.36 below.

3.19 Our series of proposals aimed at energy efficiency in the housing stock were outlined earlier in chapter 2. They are equally important to the promotion of low-carbon generating technologies as they are to energy efficiency. They are that:

- Government confirms its ambition to support the move towards carbon-neutral developments, through implementation of the Code for Sustainable Homes and making clear that this will set the direction for further tightening of Building Regulations. Carbon neutrality will not be possible in most developments without some form of distributed energy;
- We will undertake a feasibility study into the Thames Gateway becoming cost-effectively a low carbon development area within a decade, and whether and how fast we can move towards zero carbon thereafter. We will look in that context at the major role distributed generation can play in achieving low carbon development; and
- We will consult on the form of the third phase of the Energy Efficiency Commitment (EEC) in the second half of this year. We will consider whether to make changes to EEC that could allow all forms of microgeneration to be eligible under the Scheme.

Large-Scale Combined Heat and Power

3.20 While many of the most exciting growth opportunities in Combined Heat and Power lie with community and building level schemes, and while the Government is bringing forward a range of measures to encourage these[27], the great majority of our CHP capacity will continue to come for the near future from large-scale plant. Because it cannot be transported long distances, opportunities to use the heat from large electricity plants are limited mainly to places where a large industrial heat user is located nearby. But where a long-term buyer for the heat can be found, we must ensure that the full potential of large-scale CHP is captured.

3.21 Between 1997 and 2000 favourable market conditions, in conjunction with the Government's stricter consents policy for new generating plant led to a strong rise in CHP capacity. Total capacity stood at 5.6 GW in 2004, 90% of which was in large-scale plant. Modelling by Cambridge Econometrics, assuming a medium allowance price under the EU Emissions Trading Scheme (EU ETS), estimates that by 2010 total CHP capacity will be in a range 9.3 – 9.6 GW. This modelling is subject to uncertainty and depends significantly on carbon price assumptions.

3.22 Concerns have been raised about the impact of Phase I of the EU ETS on CHP. In developing the Phase II National Allocation Plan the treatment of

27 Set out elsewhere in this chapter.

CHP has been carefully considered. Government has consulted on proposals to create a separate sector for incumbent (existing) Good Quality CHP plant and a ring-fenced New Entrant Reserve for new plant generating Good Quality CHP electricity. Government has also consulted on favourable allocation arrangements to new entrant CHP relative to non-CHP through the New Entrant Reserve. We have decided to introduce changes that will result in more favourable treatment for CHP in Phase II than in Phase I. Announcements will be made in due course.

3.23 Various other policy measures were introduced to support CHP as part of the Climate Change Programme. These include:

- Climate change levy exemptions on fuel inputs to Good Quality CHP and on all Good Quality CHP electricity outputs;
- Enhanced Capital Allowances eligibility to stimulate investment;
- Reducing the rate of VAT rate to all domestic micro-CHP appliances.

Distributed Electricity Generation

3.24 Many of the economic incentives and the potential barriers to investment in medium-scale electricity stations, whether connected to the distribution or the transmission network, are shared with large-scale generation and are discussed in chapters 5 and 7. The specific circumstances and barriers facing CHP and microgeneration are also addressed separately. A description of the types of generation connected to the distribution network is set out in box 3.3.

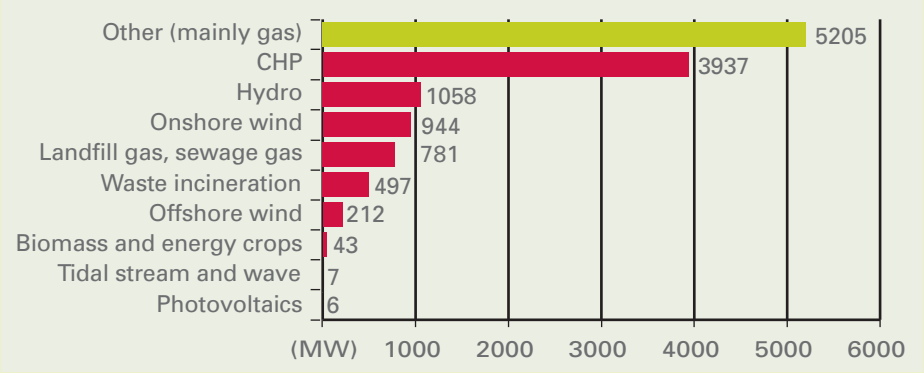
BOX 3.3. BREAKDOWN OF ELECTRICITY GENERATION CONNECTED TO DISTRIBUTION NETWORKS

The majority of our current distributed electricity generation takes the form of medium-scale dedicated electricity plant (see chart 8). Its heat is not captured. This plant operates in essentially the same way as large plant but connects directly into a distribution network rather than the transmission grid. In this report, we make a number of proposals for bringing forward more renewable electricity generation.

The vast majority of the UK's Combined Heat and Power plant (CHP) is located on industrial sites; very little of it provides electricity for residential buildings. Most of our CHP is fuelled by gas, though a small proportion is CHP plant fuelled by biomass/waste. CHP represents around 7% of UK electricity. Two thirds of this connects into distribution networks, the rest to the transmission network.

The final form of distributed electricity generation is microgeneration in the home or in a larger building, for example micro-CHP, mini wind turbines or solar photovoltaic panels. See Microgeneration heading, below. There are only around 3,000 installations currently in place in the UK. These can also be used to supply surplus electricity back to the distribution grid. A negligible amount of our electricity is generated in this way.

CHART 8. GENERATION PLANT CURRENTLY CONNECTED TO UK DISTRIBUTION NETWORKS



Source: DTI, 2006.

3.25 However, investors in these diverse technologies share a common interest in being able to access the distribution grid without undue hassle and in being rewarded appropriately for selling electricity and other services such as balancing of the distribution system. It is also in the interests of these investors for Distribution Network Operators (DNOs) to invest in distribution networks and to explore innovative ways of more efficiently meeting the demands and realising the benefits of increases in distributed generation.

3.26 There is an argument that greater long-term certainty around future industry direction would facilitate more investment and innovation in the networks than Ofgem's current 5-year pricing reviews allow. This needs to be reconciled with Ofgem's need to ensure that investments in networks are cost-effective and do not create unnecessary costs for consumers. In this regard we welcome Ofgem's recent announcement that it will draw together and publish scenarios for the potential long-term development of the networks.[28]

3.27 Ofgem and the Government have done much over the last five years to improve arrangements for medium-scale generators. In 2004 Ofgem announced new incentives for distribution companies to connect all forms of distributed generation, and to invest more in innovation. These incentives only apply to new connection applications since April 2005, so there is as yet limited experience of their operation. Work is also ongoing between Ofgem and the industry in regard to small-scale installations.[29]

3.28 The Government remains concerned, however, to ensure that the overall impact of the regulatory regime is not to discriminate against distributed generation in any unjustifiable way or to disincentivise desirable investment in distribution networks. It is possible, for example, that current price controls create an unnecessary disincentive for Distributed Network Operators (DNOs) to invest in upgrades or to facilitate connection of small generators.

28 Ofgem has committed to take into account the joint Ofgem-Government review announced below in the development of these scenarios.

29 In particular, projects under the Distribution Working Group are looking at a wide range of issues including connection terms, metering/trading and access to the incentives for renewable generation. However, other groups (e.g. the BSC and CUSC Panels, the Grid & Distribution Code Review Panels, the DTI and Ofgem's recently formed Microgeneration Forum) are also dealing with issues that impact unlicensed generators. (This work is focussed on electricity rather than heat).

3.29 A number of submissions to the Review highlighted more specific regulatory barriers, for example in relation to licensing. Among other things, the licensing regime offers protection to consumers and, through competition, ensures that consumers can choose their suppliers. However it was argued to us that the current class exemption regulations for electricity licencing place an unnecessary limit on the economic potential of private wire networks, by limiting supply to residential customers to 1 MW (about 1,000 homes) for each private wire site and placing a 5 MW aggregate limit on trading between sites.

3.30 In this context, the Government and Ofgem will lead a comprehensive review of the incentives and barriers that impact on distributed electricity generation including CHP. This Review will report in the first half of 2007. Its scope will include, but not be limited to:

- The economic and other incentives on suppliers to buy electricity from distributed generators;
- The economic costs and benefits, and other incentives on DNOs to connect new generators and to invest in upgrading distribution networks in order to accommodate increasing amounts of distributed generation;
- The incentives on DNOs to engage in innovation aimed at minimising the costs and capturing the benefits of distributed generation;
- Options for resolving potential barriers to the sale of electricity from small generators, for example:
  - licensing procedures; and
  - technical standards for connection and for network operation.

This review will take place in combination with the study announced in the 2006 Climate Change Programme into the licensing and exemption arrangements govering small-scale CHP and renewables.

3.31 In addition, the Climate Change and Sustainable Energy Act 2006, which received Royal assent in June, empowers Government to require all energy suppliers, through licence modifications, to offer to acquire exported electricity. The Secretary of State has to make a decision whether to use these powers twelve months after commencement, that is, in the second half of 2007. If energy suppliers do not develop a system to acquire electricity from microgenerators, the Government will intervene.

Microgeneration

3.32 Microgeneration refers to small-scale installations that generate heat, electricity or, in the case of micro-CHP, both. Potentially installed in an individual home, better opportunities for microgeneration are often found in larger buildings or developments where scale benefits can be accessed, for example in a school, building development or hospital (see box 3.4).

3.33 Microgeneration has been the focus of particular Government attention over the last 6 – 12 months, with the Microgeneration Strategy (April 2006) enhanced by the Climate Change and Sustainable Energy Act 2006 and Budget 2006. The Microgeneration Strategy will be implemented aggressively by Government, and the powers acquired by Government under the Climate Change and Sustainable Energy Act 2006 will be exercised where appropriate.

Key policies include:

- Easier access to the monetary benefits of Renewable Obligation Certificates;
- Producing reports on energy measures for local authorities – including promoting microgeneration – that authorities will have to have regard to in the exercise of their functions, under the Act;
- Promoting community energy projects;
- A review of communications activity to assess how to improve information provision; and
- A new power for Parish Councils to promote microgeneration in their own parishes.

BOX 3.4: MICROGENERATION

Microgeneration is defined in section 82 of the Energy Act as the small-scale production of heat and/or electricity from a low carbon source. The technologies covered by this definition are:

- Heat producing technologies:
  - Solar water heating installations account for 79,000 out of the total of 82,000 installations
  - Heat pumps (ground source, air source, water source). Ground source heat pumps are starting to gain prominence as on 'off gas-grid' heating solution, but the requirement for ground works makes them more attractive in new build or as part of a substantial refurbishment
  - Biomass stoves and boilers provide space and/or water heating from a variety of fuels such as wood pellets, woodchips, logs and non-wood fuels.
- Electricity producing technologies:
  - Solar photovoltaics can take the form of a bolt-on panel or roof-tiles and are perhaps the most architecturally attractive technology, yet remain one of the most expensive solutions in most cases
  - Micro-wind. Small-scale building-mounted turbines are a relatively new innovation and are one of the cheapest technologies
  - Micro-hydro installations are limited by the availability of suitable locations
- Combined heat and power technologies at the small-scale mainly use natural gas as a fuel but provide electricity as well as heat. The two systems closest to market use reciprocating engines or Stirling engines, with fuel cells being an alternative source of power.

3.34 Budget 2006 allocated an additional £50m of capital grants for microgeneration. Using this fund, *Government is working to set up a framework agreement whereby a number of suppliers agree to provide microgeneration installations at reduced prices*, secure in the knowledge that they will have access to the market created by the £50m grant funding. This is designed to provide a level of certainty for suppliers in return for reduced retail prices for their products. It is hoped that participation in the framework will encourage suppliers to invest in larger-scale production, bringing down prices on a permanent basis and stimulating demand yet further. Expressions of interest were published mid-June, and we aim to have the programme up and running by the end of the year.

3.35 The Government is giving particular attention to schools. We have already pledged significant funds (around £5.5 billion in 2005 – 06) to spend on maintaining and improving school buildings, with the aim of rebuilding or renewing every secondary school and refurbishing half the primary schools in England over the next 10-15 years. We need to ensure that these new and refurbished schools demonstrate substantial energy efficiency savings and carbon reductions.

3.36 As announced in the Microgeneration Strategy, Government is also working on changes to the planning system which will make it much easier for homeowners to install microgeneration equipment on existing houses. The aim of this work is to ensure that, as far as possible, homeowners will be able to install solar panels, photovoltaic cells, domestic wind turbines, etc without having to apply for planning permission.

3.37 Government recognises that uncertainty over the planning status of new equipment, and the cost and time it takes to obtain planning permission, are real barriers to the more rapid adoption of such technologies. We are therefore proposing to ensure that, as far as possible, all such technologies are exempted from the need for a specific planning application through the General Permitted Development Order (GPDO).

3.38 The most recent version of the GPDO came into force in 1995, when few people were aware of microgeneration's potential and so was not drafted to accommodate it. Government will therefore up-date it, with the objective of making these new technologies "permitted development", wherever this can be done without removing essential safeguards that protect the interests of neighbours and local amenity.

3.39 This work will involve amending a Statutory Instrument (SI) and it is necessary to undertake appropriate public consultation before changes come into force. The key target dates for this work are as follows:

W/c 5 June 2006	Consultant contract commences
September	Consultants complete assignment
End October	Interim report to Parliament Public consultation commences (3 months)
End Jan 2007	Consultation ends
Spring 2007	SI and User Guidance drafting completed – 6 week consultation
Summer 2007	Secretary of State reports to, and SI laid before, Parliament
Autumn 2007	Commencement

Developing alternative fuels for heat

3.40 It is difficult to break down precisely the sources of heat used in the UK, as use of fuels outside the gas grid is not measured comprehensively. It is estimated that around three quarters of our heat comes from gas delivered through the national gas grid. Another 8% comes from electricity, for example in the form of electric heaters in the home. The remainder is 'distributed' heat generation, most of it from fossil fuels (eg domestic coal fires or heat from

coal or oil used in industrial processes), and a small portion from renewables (e.g. from biomass/waste plant, solar heating panels, geothermal and/or heat pumps).

3.41 Some investors in low carbon renewable heat technologies are put off by uncertainty in the long-term demand for their product, inhibiting investment and cost reduction. While some of these technologies are mature, others have the potential for significant cost reduction. Even the mature technologies, such as biomass, could enjoy cost reductions with scale and the development of supply chains.

3.42 Costs will come down only with a much more vibrant market. The best way to strengthen market development is to combine grant funding with appropriate incentives on the users of heat to invest in low-carbon solutions. We make a number of proposals, outlined earlier in this Chapter, to underpin the long-term demand from buyers of heat (such as households, developers, local authorities and central government) to invest in low carbon technologies.

3.43 As well as taking measures to underpin demand, it is essential to remove barriers to the development of emerging low-carbon heat technologies. Aggressive implementation of the Microgeneration Strategy, outlined in paragraph 3.33, will benefit low carbon micro-heat installations. In the specific case of biomass, Government recently committed in its response to the Biomass Task Force report (April 2006) to taking forward a wide range of initiatives aimed at removing barriers to market development.

3.44 The Climate Change and Sustainable Energy Act 2006 placed a duty on the Secretary of State to promote renewable heat. The UK provides a direct incentive for renewable electricity generation (the Renewables Obligation) and will be bringing into force a Renewable Transport Fuels Obligation in 2008, but no equivalent instrument for renewable heat. While renewable heat technologies have received grant funding through Clear Skies, Bioenergy Capital Grants Scheme, Community Energy and the Low Carbon Buildings Programme, and while we have committed further funding to renewable heat in England through a new 5-year Biomass Heat/CHP programme,[30] they do not receive additional revenue support.

3.45 There have been a number of calls for a Renewable Heat Obligation or other market-based mechanisms to support renewable heat. In particular we note that in the absence of an equivalent to the Renewables Obligation there is potential for a distortion of the market for biomass in some regions, as demand from local biomass or co-fired electricity plant pushes up its price. The Biomass Task Force found that the most efficient use of biomass is in dedicated heat or preferably CHP plants, rather than dedicated electricity plant, and that there are circumstances where biomass heat was already economic.

3.46 The Government noted in its response to the Biomass Task Force (April 2006) its recommendation that a Renewable Heat Obligation should not be pursued at this time, but indicated that we would further consider the evidence on such a measure. However a number of practical difficulties need to be addressed in relation to the implementation of a direct market-based

30 Announced in the Climate Change Programme Review (2006)

incentive for heat. Unlike the transport fuels market, and the electricity market, where there are easily identifiable suppliers, both the supply and demand for heat are very diverse. There are difficulties in defining on whom a Renewable Heat Obligation, for example, would be placed, and how the amount of low-carbon fuels provided by a supplier could reliably be measured. There is also a risk that measurement and management required to run such a scheme would create significant administrative burdens.

3.47 We will however continue to be open to solutions to these practical issues and will report on this in April 2007. The proposed EU Renewable Heating and Cooling Directive, expected later this year, and further developments of the market for renewable heat technologies over time may hasten this process. We will also consider outputs from the recently launched Carbon Trust's £5m Biomass Heat Acceleration Projects, which aims to help make the biomass heat market self-sustaining by reducing costs and addressing supply-chain risks.

Is Distributed Energy an Alternative to a Centralised System?

3.48 Our current energy system serves us well in many ways. It captures scale benefits in electricity and in the distribution of heating fuel. Recently announced price control proposals will see up to £5 billion invested by 2012 with a minimal impact on bills, and efficiency gains have halved costs in the electricity transmission network since privatisation. Our networks are 99.98% reliable[31] and meet high safety standards. We are beginning to see a marked growth in uptake of renewables, and the prospects for offshore wind are promising. We must protect the best of these outcomes, while grasping the potential of distributed energy to reduce emissions, increase reliability of supply and reduce costs.

3.49 Moving towards a distributed energy system will bring challenges. For example, potential savings due to a reduced need for investment in large power stations cannot be captured until we have reliable capacity in small-scale plant. Given the current low levels of small-scale generation, this may take many years. And the technologies necessary for a truly distributed energy system, notably electricity storage, are still emerging. Investment in networks will need to continue over the next ten to fifteen years to ensure that renewables, particularly in the north of Scotland and offshore, are brought online. See annex E.

3.50 Cost is currently a key limiting barrier for many of the technologies, especially in small scale electricity generation. The stiffening up of long-term demand and the removal of barriers, along with the measures announced in this report, in Budget 2006 and in the Microgeneration Strategy, are major steps in bringing these costs down. In particular, our comprehensive review with Ofgem will aim to ensure that we have the right regulatory framework for Distributed Network Operations and the National Grid to invest appropriately, as part of their re-investment cycles, in technologies that will allow the long-term transition towards a more distributed energy system.

31 Source: Ofgem

3.51 Because the most economical and most convenient opportunities for uptake of community and local energy are in new build, the shift will not happen overnight. And the kinds of communication and information measures laid out in the Microgeneration Strategy and the Government Response to the Biomass Task Force are crucial if there is to be quicker take-up of microgeneration than we have seen with energy efficiency technologies.

3.52 In the meantime, innovators are finding ways to make the economics work, in particular by making efficient use of fuels through CHP schemes. They must be encouraged. One benefit currently available to the customers of some private wire networks is that they do not pay the costs of the Climate Change Levy, the Renewables Obligation, transmission extension or distribution upgrades. Yet some of these networks feed into the grid and rely on it for back-up. As this kind of distributed electricity grows, the impact on prices for grid-users (who do pay these costs) will grow. In the early stages of growth for distributed generation, the impact of this cross-subsidy will be minimal.

3.53 In the light of the many competing considerations in this area, and of the real potential of distributed energy systems, we will undertake a wide-ranging review of the long-term potential and challenges of distributed generation, including Combined Heat and Power, as an alternative or large-scale supplement to centralised generation. Incorporating a range of scientific, technical, economic and behavioural issues, it will be taken forward as part of a Foresight Project looking at sustainable energy management in the built environment, by the Office of Science and Innovation.

3.54 We must recognise however that we will be heavily dependent on much of our centralised infrastructure for decades to come. We need to foster the growth and development of distributed energy in a way that maintains and strengthens the safety and reliability of supply. And energy must remain affordable. In order to achieve our carbon and energy security goals, we must make the most of our renewable resources – such as wind and, in the longer term, marine. These are located predominantly in such remote locations that much of the electricity they generate will have to be transported to energy users in distant locations through our transmission networks.

DISTRIBUTED ENERGY: SUMMARY OF PROPOSALS

Incentivising Community and Building Level Distributed Energy

1. **Government confirms its ambition to support the move towards carbon neutral developments, through implementation of the Code for Sustainable Homes and making clear that this will set the direction for further tightening of Building Regulations. Carbon-neutrality will not be possible in most developments without some form of distributed energy.**

2. **We will undertake a feasibility study into the Thames Gateway becoming a low carbon development area within a decade, and whether and how fast we can move towards zero carbon thereafter.**

3. **We will consult on the form of the third phase of the Energy Efficiency Commitment (EEC3) in the second half of this year. We will consider whether to make changes to EEC that could allow all forms of microgeneration to be eligible under the Scheme.**

4. **In the longer term, Government will work with a wide range of industry and consumer groups to consider whether EEC3 could be replaced with an obligation on suppliers to cap growth of emissions from the household sector. Distributed energy and energy efficiency options investments will be the most common way of achieving this goal.**

5. **We will shortly announce a new statutory duty on the GLA on climate change. This should give a further boost to the growth of distributed generation in the capital.**

6. **We will expect all planning authorities to include policies in their development plans that require a percentage of energy in new developments to come from on-site renewables, where viable.**

7. **We will set out proposals that provide a framework to encourage all planning authorities to take action on climate change, in the Local Government White Paper later this year.**

8. **We will consult on a range of options to improve energy efficiency in the large commercial sector including the option of a mandatory emissions trading scheme. This consultation will also consider whether larger Local Authorities and public bodies should be included in these measures. If included, this would provide a direct financial incentive on these bodies to invest in low carbon heat and electricity technologies in their own buildings.**

9. **We will aim to achieve carbon neutrality in the central government estate by 2012 (as described in Chapter 2).**

Large-Scale Community Heat and Power

10. **We have decided to introduce changes to allowance allocations that will result in more favourable treatment for CHP in Phase II of the European Emissions Trading Scheme than in Phase I. Announcements will be made in due course.**

Distributed Electricity Generation

These proposals are in addition to the proposals made in the Renewables section to bring forward renewable generating capacity.

11. **The Government and Ofgem will lead a comprehensive review of the incentives and barriers that impact on distributed electricity generation including CHP. This Review will report in the first half of 2007. Its scope will include, but not be limited to:**
    - **The economic and other incentives on suppliers to buy electricity from distributed generators;[32]**

32 eg The impact of the Balancing and Settlement Code on rewarding exported electricity.

- **The economic and other incentives on DNOs to connect new generators and to invest in upgrading distribution networks in order to accommodate increasing amounts of distributed generation;**
- **The incentives on DNOs to engage in innovation aimed at minimising the costs and capturing the benefits of distributed generation;**
- **Options for resolving potential barriers to the sale of electricity by small generators, for example:**
  - **licensing procedures (including exemptions);**
  - **technical standards for connection and for network operation.**

12. **The Climate Change and Sustainable Energy Act 2006 empowers government to require all energy suppliers, through licence modifications, to offer to acquire exported electricity. The Secretary of State has to make a decision whether to use these powers twelve months after commencement, that is, in the second half of 2007. If energy suppliers do not develop a system to acquire electricity from microgenerators, Government will intervene.**

13. **Government will undertake a wide-ranging review of the long-term potential and challenges of distributed generation, including Combined Heat and Power, as an alternative or large-scale supplement to centralized generation. Incorporating a range of scientific, technical, economic and behavioural issues, it will be taken forward as part of a Foresight Project looking at sustainable energy management in the built environment, by the Office of Science and Innovation.**

Microgeneration

14. **The Microgeneration Strategy will be implemented aggressively by Government, and the powers acquired by Government under the Climate Change and Sustainable Energy Act 2006 will be exercised where appropriate. Key policies included:**
    - **Easier access to the monetary benefits of Renewable Obligation Certificates;**
    - **Producing reports on energy measures for local authorities – including promoting microgeneration – that authorities will have to have regard to in the exercise of their functions;**
    - **Promoting community energy projects;**
    - **A review of communications activity to assess how to improve information provision; and**
    - **A new power for Parish Councils to promote microgeneration in their own parishes.**

15. **Government will consult on changes to the Planning system with a view to making it easier for householders to install microgeneration equipment on existing houses by removing the need to submit a planning application.**

Alternative fuels for heat

16. **Proposals 1-9 and 13-14 will all impact on alternative heat technologies.**

CHAPTER 4

Oil, Gas and Coal

Today around 90% of the UK's energy needs are met by fossil fuels, and they will continue to be the predominant source of energy for decades to come. Energy plays an important role in our economy and lifestyles; therefore we need to be confident that the market and Government energy policy will deliver reliable supplies of energy at competitive prices to people and businesses.

4.1 Like most countries we already import coal, gas and oil to meet our needs. As production from our own oil and gas fields and coal reserves declines, we will become yet more reliant on imports. By 2010, imports could be meeting up to 40% of the UK's total gas demand, rising to 80 – 90% by 2020. The UK is also expected to become a net importer of oil (on a sustained basis) by 2010, and we are already a net importer of coal.

4.2 We need to have confidence in the international markets where we will source supplies. Getting more of our energy from further away will inevitably mean longer and more complex supply chains, and we need to be sure that our market framework is robust for this new situation.

4.3 To achieve this we need a resilient and flexible energy system. This means a diverse system based on a mix of fuel types, a variety of supply routes, international markets that efficiently allocate resources, back-up facilities such as storage, and a robust infrastructure to transport energy supplies to centres of demand.

BOX 4.1: THE ROLE OF OIL, GAS AND COAL IN THE UK ENERGY MIX

Developments in low carbon technologies and improvements in energy efficiency will act to reduce demand for and thus decrease our reliance on imported fossil fuels. Nevertheless, fossil fuels will constitute the majority of our energy mix for the foreseeable future, particularly oil and gas. Global energy resources are still plentiful, and markets are well-developed to deal with increased trade.

Nearly our entire transport system relies on petroleum products, in the form of petrol or diesel for road transport and kerosene for aviation. Our homes and places of work are mainly heated by gas, and in recent years gas has also increased its share in the electricity generation mix. Even with the growing importance of gas in the generation mix, coal-fired generation continues to meet around a third of electricity demand on average and during the winter of 2005/2006, in response to high gas prices, it met about half of demand. This illustrates the important contribution made by coal-fired generation to the UK's energy security and the flexibility of its energy system.

International Energy Security

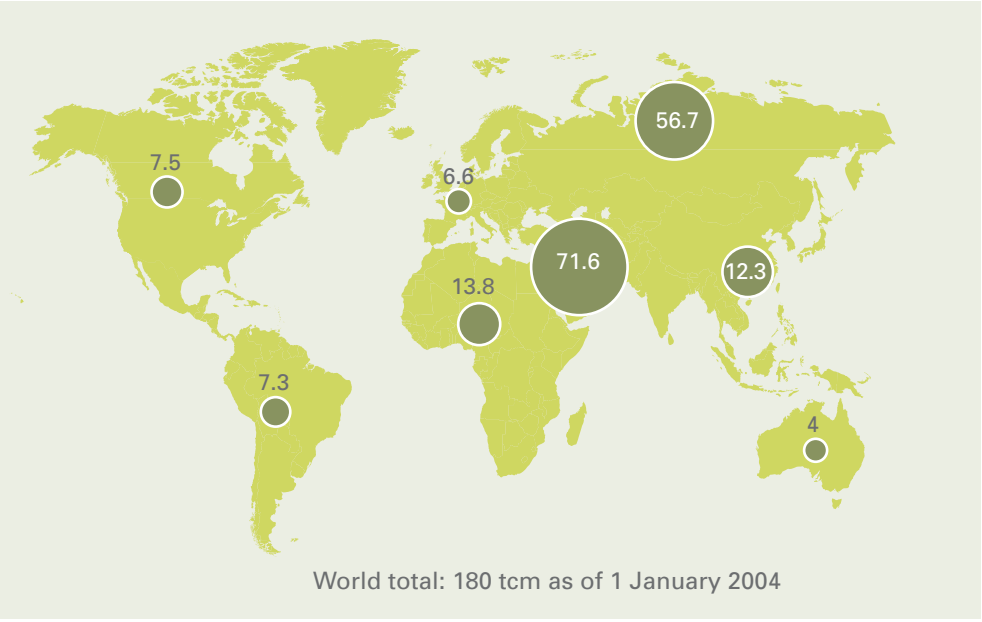
4.4 As our demand for imports increases, so our energy security will be increasingly linked to the reliability of suppliers and the effectiveness of the international markets for oil, gas and coal.

Reliable suppliers

4.5 Global coal reserves are dispersed and abundant throughout the world and we have well-established relationships with our key suppliers. In 2005, approximately 44Mt of coal, or three quarter of total UK consumption, was imported from a number of source countries including South Africa, Russia, Australia and Colombia.[33]

4.6 Global oil and gas reserves are heavily concentrated, in Russia, Central Asia, the Middle East and North Africa. The Middle East will remain the largest oil producing region; OPEC holds approximately 75% of proven reserves and its market share is projected to rise from 40% in 2005 to 50% in 2030. In 2004 the UK imported 90 million tonnes of oil and 14 million tonnes of oil equivalent of gas.[34]

CHART 9. WORLD PROVEN RESERVES OF NATURAL GAS (2004)



Source: Cedigaz, 2004

4.7 It is in gas where our demand for imports will grow most strongly, providing up to 80 – 90% of expected consumption by 2020. Norway will remain a significant supplier of gas to the UK in the medium term, along with Algeria and Qatar. Over time we are likely to import more from other potential areas such as Russia, the Caspian and Nigeria (chart 9 illustrates where natural gas resources are located).

33 Source DTI Energy Trends www.dti.gov.uk/energy/statistics/source/index.html
34 At the same time we exported 93 million tonnes of oil and petroleum products and 7 million tonnes of oil equivalent in gas.

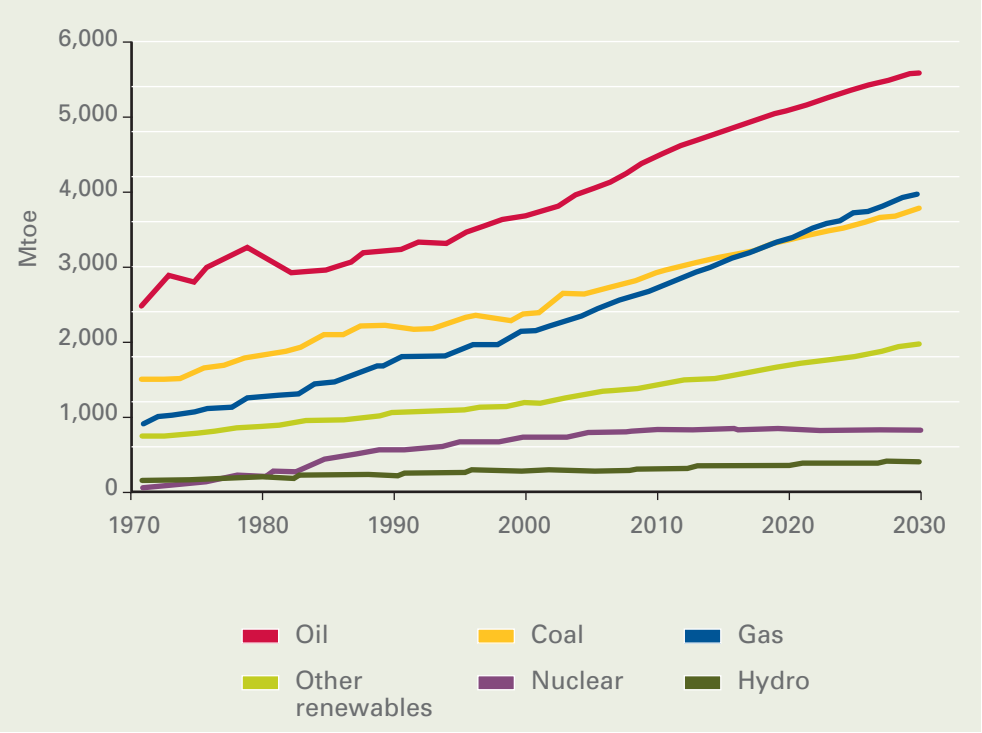
4.8 There are strong incentives for supplier countries to build reliable relationships with consuming countries given their heavy reliance on the revenues from the energy they export. Nevertheless, the UK's exposure to international risks will increase gradually over the medium term, as our net energy imports increase and as supply chains lengthen. These risks include:

- constraints on the investment needed in the exploration, production and transport of energy;
- limited access to reserves or transport infrastructure. Over half the world's oil reserves, for example, are either completely restricted to national oil companies, or offer only limited access to international business;
- a lack of information or misunderstandings between consumers and producers about their respective policies;
- inequality, social unrest, corruption and the threat of terrorism. They compromise the working environment, increase the likelihood of supply disruptions, hamper investment and increase the costs of oil and gas; and
- accidents and natural phenomena. They are difficult to predict, but their impact on global and regional markets can be significant, as we witnessed after Hurricane Katrina last year. The risk of accidents will increase as supply chains lengthen and trade in energy expands.

4.9 The impact of these risks – whether in leading to sharply increased prices or curtailing supply – needs to be evaluated against trends in the world's demand for energy.

4.10 There has been strong growth in energy demand worldwide, particularly in emerging economies, such as China and India. Greater competition for energy supplies is leading to tighter global energy markets and higher prices (chart 10 shows projected energy demand by fuels up to 2030).

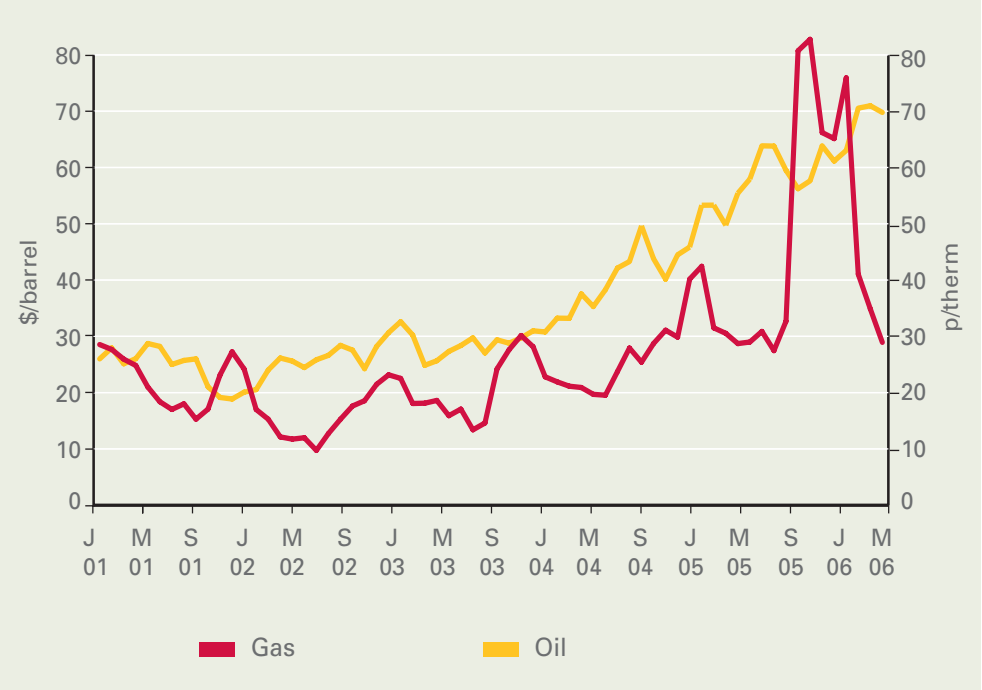
CHART 10. GLOBAL ENERGY DEMAND TO 2030, BY FUEL



Source: IEA, 2005

4.11 Global oil demand grew by 4.2% in 2004, and global coal demand rose by an estimated 8%, with particularly strong growth in China. Oil prices have more than doubled and coal prices have risen by nearly a third over the last three years. Gas prices have also increased by more than 50% over the same period (see chart 11).

CHART 11. OIL AND GAS PRICES



Source: DTI, 2006

Effective markets

4.12 International trade in fossil fuels is expected to double by 2030, increasing the interdependence of consuming and producing regions. The effectiveness of global energy markets where this competition for resources will be played out is therefore of crucial importance. There are a number of challenges that need to be addressed:

- there are problems with transparency (particularly of data) in the oil market;
- progress towards liberalisation in the EU energy market – a key source of gas supplies for the UK – has been disappointing. Reports by the European Commission cite a number of weaknesses: the high degree of market concentration; vertical integration being used as a barrier to new entrants; the lack of market integration; the lack of transparency; and the need for well functioning and transparent market mechanisms for setting prices. At the same time, the Commission is becoming more active in promoting competition in the energy sector, and we support this; and
- the market for Liquified Natural Gas is also still developing (see box 4.2).

BOX 4.2: LIQUEFIED NATURAL GAS

Liquefied Natural Gas (LNG) is natural gas which has been liquefied by reducing its temperature to minus 160 degrees Celsius at atmospheric pressure, usually to allow for transportation by ship. Upon reaching its final destination LNG can be re-gasified and injected into a country's gas pipeline system.

In 2005 LNG producers included Indonesia, Malaysia, Qatar, Algeria, Australia, Trinidad & Tobago and Nigeria. Major importing countries included Japan, South Korea, Taiwan, USA, Spain and France. LNG accounts for around a quarter of internationally traded gas and 7% of global gas demand, and is growing fast. It is currently mainly traded on a regional basis, serving consumers in the Atlantic Basin and Asia Pacific.

However, LNG offers the potential to create a more global market for gas by creating a link between these two main consuming regions. LNG can also enable gas-importing countries to have more diverse gas supplies and import routes, thereby potentially increasing security of supply and competition. Worldwide, significant additional capacity in export facilities, shipping and import facilities is planned; by 2010 such capacity is expected to have broadly doubled. The UK is expanding its LNG import facilities, adding more than 100 million cubic meters/day of capacity over the next five years.

4.13 To respond to these challenges, our international energy security strategy will be reviewed later this year and will focus on the following outcomes:

- **An open international energy markets framework**
  - we will continue our drive for EU energy markets liberalisation and integration, by working with the European Commission to enforce and strengthen internal market legislation and to make full use of European competition rules to tackle anti-competitive practices, and to influence the future direction of European energy policy as set out in the European Commission's Green Paper "A European Strategy for Sustainable, Competitive and Secure Energy" published on 8th March 2006.
  - we will work to achieve an open investment framework in the production and transportation of energy that allows the best technology, skills and experience to be deployed around the world to best effect, and a system of clear, stable and non-discriminatory rules and regulations for activity in the energy sector.
  - we need to ensure that there is an effective regulatory framework to enable business to exploit oil and gas fields and have the confidence to invest in new pipelines. Building and consolidating political links with Norway, Algeria, Qatar, countries of the Caspian region and other states will be important to enable the private sector to establish contracts with potential suppliers.
  - we will work with other member states and the European Commission to build a stronger voice across Europe when speaking to third countries seeking to invest in the European energy market.

  - We will also work to remove barriers to enable both producing and transit nations to join multilateral treaties such as the European Energy Community Treaty and the Energy Charter Treaty. These instruments establish rules which govern trade and investment in energy and related equipment, and enable disputes to be resolved through law.
- **Transparency and good governance in the energy sector**
  - transparent, accurate and timely data help the market function effectively, allowing prices to signal the required levels of investment. We will therefore continue to promote the Joint Oil Data Initiative (JODI) as a credible mechanism for the exchange of oil market information; and explore with our international partners how the publication of objective data might similarly improve the way in which gas markets function.
  - We will continue to promote the Extractive Industries Transparency Initiative as applicable to all energy resource-rich countries.
- **Effective international contingency arrangements to guard against physical supply shocks in world oil markets**
  - Existing IEA oil emergency response mechanisms proved to be effective in response to the disruptions caused by Hurricanes Katrina and Rita. However, the proportion of world oil consumed by non-IEA countries is increasing. We will therefore continue to support the work of the IEA in encouraging member and non-member countries to maintain and develop oil security arrangements for use in the event of oil supply disruptions.
- **Political and economic stability in source and transit regions**
  - We will continue, through the UK's foreign policy, bilaterally, through the EU and through multilateral organisations, to promote security, justice and prosperity globally.

Making the most of our own resources

4.14 Making efficient use of the UK's own energy reserves brings obvious benefits both in the contribution it can make to a diverse UK energy mix but also to the economy in terms of jobs, investment and national income generated by the sector.

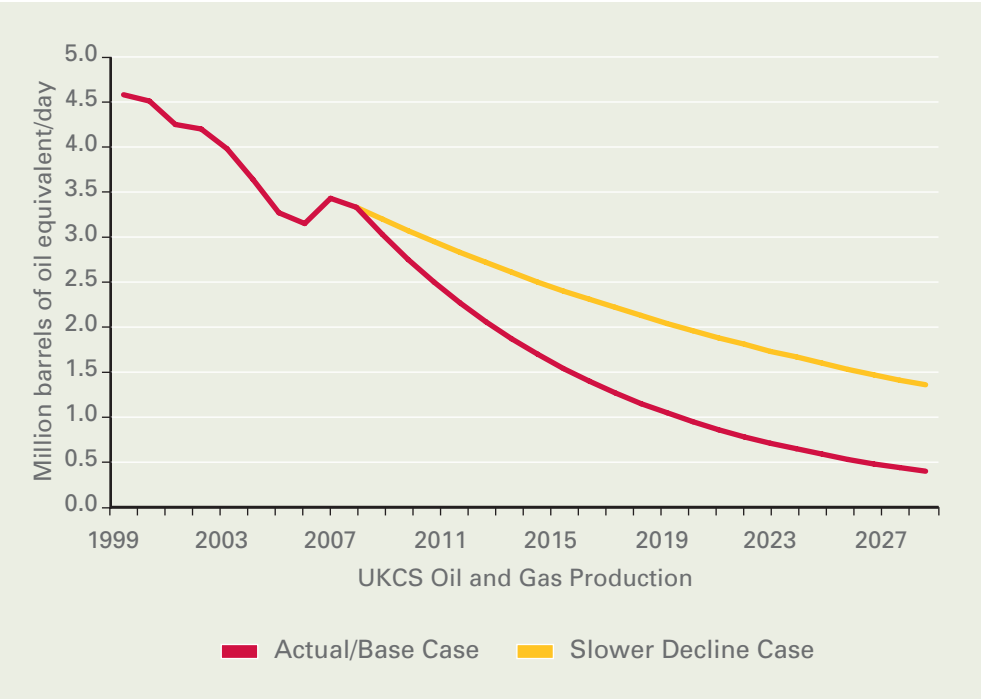
4.15 Oil and gas production from the UK continental shelf (UKCS) peaked in 1999, and currently still supplies three quarters of our total energy needs. Production is expected to rise strongly in 2007 – capital expenditure has been higher in response to high oil prices and the large Buzzard oil field will soon reach full production – but will fall afterwards.

4.16 Coal producers in the UK continue to produce around 20Mt of coal each year, despite a significant decline in production over the last decade. This met around a third of demand from UK generators who are the biggest consumers of coal produced in Britain, with a small proportion being used in heavy industry and to heat homes.

Oil & Gas

4.17 After 40 years, UKCS production is now declining. However high oil prices encouraged a record number of offshore licence applications last year[35]. If the 9% per annum trend decline rate seen over the last 3 years is resumed after 2008, production would follow the path illustrated by the base case profile in chart 12. However, if investment levels are maintained, the rate of decline could be slowed, to perhaps 4% a year as illustrated by the slower decline case in the chart. That would deliver significantly higher oil and gas production (an extra 1 million barrels of oil equivalent (boe) a day in 2020) and, consequently, greater recovery of the UK's remaining oil and gas reserves (nearly 7 billion boe of extra production by 2030).

CHART 12. TOTAL UK CONTINENTAL SHELF OIL AND GAS PRODUCTION (TO 2030)



Source: DTI – United Kingdom Offshore Operators Association, 2006

4.18 Geology and the levels of future oil and gas prices will be key determinants of future investment activity, but we need to ensure that the right conditions are in place to attract investment in exploration, development and production; Government is already working closely with industry to achieve these objectives through PILOT (a joint Government and industry oil and gas task force set up in 1998 aimed at making the North Sea more competitive), which has helped generate significant interest in offshore investment in recent years.

4.19 There are a number of areas where concerted action now by Government and industry will boost investment in the UKCS over the next 10 to 15 years irrespective of oil and gas prices:

35 The 2005 Round was one of the most successful Offshore Licensing Rounds ever, with the highest level of Blocks being applied for in 30 years.

- **Maximising investment in already producing fields.** Using regulatory powers if necessary, Government must press for full investment in fields that are already producing, We will immediately refocus the DTI's Stewardship initiative[36] on maintaining reliability and encouraging nearby exploration and should see results in these areas by the middle of next year.
- **Establishing a Taskforce for meeting infrastructure needs to the west of Shetland.** We are establishing a Taskforce with Industry to get the right infrastructure (for example pipelines) in place to the west of Shetland so that, with minimal impact to the environment, we can speed up development and exploration in the area. The Taskforce will report by the end of the year.
- **Ensuring the development of a dynamic market fit for the future.** The commercial framework needs to change so that it encourages the industry to be dynamic in the future by facilitating a strong market in assets and rapid access to infrastructure. For example, the DTI is moving to a web-based system of licence assignments that will substantially speed up deal making and reduce costs, especially for smaller firms. We will also continue to build on the work of PILOT to secure the long-term future of the industry in the UK.

4.20 It is also vital to ensure we have the right fiscal approach. The Treasury is already discussing with industry the wider structural issues of the oil and gas fiscal framework. In particular, the Treasury is looking at how it can best deliver Government's objective of maximising the economic recovery of our oil and gas reserves while promoting investment and providing the UK with a fair share of the revenues from a national resource.

Coal

Current UK coal production

4.21 British coal production has fallen significantly in the last decade. In 1995/1996 over 50Mt was produced from 83 deep and 122 surface mines. By 2005/2006 production had fallen to around 20Mt from 13 deep and 31 surface mines. Two of the remaining deep mines have since been 'mothballed' by their operator.

Support for UK coal producers

4.22 The Government has provided support schemes for the industry. In 2000-2002 the DTI operated the UK Coal Operating Aid Scheme. £163m was approved to pay operating aid. Coal Investment Aid (CIA) was introduced in 2003 to provide up to £60m of support for capital investment by 2008.

36 The DTI "Stewardship Initiative" creates a mechanism to determine whether field owners are fully identifying opportunities and providing a means to realise them. Under the Stewardship initiative the DTI requires that asset owners consistently do the right things to identify and then exploit opportunities, and that assets are in the hands of those with the collective will, behaviours and resources to achieve this.

Remaining UK coal reserves

4.23 The Government believes that it is right to make the best use of UK energy resources, including coal reserves, where it is economically viable and environmentally acceptable to do so.

4.24 As with oil and gas production, current and forward prices and geology, which can be very challenging in the UK's mature coalfields, are key drivers of investment for UK coal production. There has been recent investment in new deep mine production, such as the re-opening of abandoned developments at Aberpergwm colliery and current work to revive Hatfield colliery. Overall the environment remains challenging with two of the remaining deep mines (at Rossington and Harworth) having been 'mothballed' over the last year.

4.25 Table 4.1 below shows estimates of deep and surface mine reserves identified in reviews commissioned by DTI in 1998 – 2004 adjusted to reflect subsequent mine closures and production and the uprating of newly proved reserves at ongoing mines. It shows an ongoing decline in reserves. Some of this decline could be reversed if surface mine output were at least maintained at recent levels subject to striking the right balance between the legitimate interests of the coal producers, the environmental impacts and the needs of communities.

4.26 In addition to this, there is thought to be in the order of 400 million tonnes of recoverable coal at other prospects, most of which would require either new mine developments or significant new investment at existing or former mines.

Table 4.1: Estimated UK Coal Reserves

				Million tonnes	
	1998/9	2002	2006	2010	2020
Deep Mines	540	151	110	100	70
Surface Mines	325+	89	45	7	–
TOTAL	865+	240	142	107	70

4.27 The Government will convene a coal forum to bring together coal-fired generators, coal producers and suppliers, power plant suppliers, trade unions, small businesses and other parties in order to help them to find solutions to secure the long-term future of coal-fired power generation and UK coal production. The forum will facilitate dialogue within the industry and work to ensure that we have the right framework, consistent with our energy policy goals, to secure the long-term contribution of coal-fired power generation and optimise the use of economical coal reserves in the UK. Further information about the forum's remit and participants will be announced shortly.

4.28 An important driver for UK coal investment is demand from coal-fired generators in the UK. Coal-fired generation continues to meet around a third of electricity demand on average and during the winter of 2005/2006 it met about half of demand, reflecting its continued importance in the UK's energy system. To have a long-term future coal needs to tackle its heavy carbon emissions. But coal-fired generation technology is becoming cleaner and

carbon capture and storage (CCS) offers the promise of genuinely low carbon electricity generation from fossil fuels. Detail about the Government's actions to promote cleaner coal and CCS are set out in Chapter 5.

Energy Imports

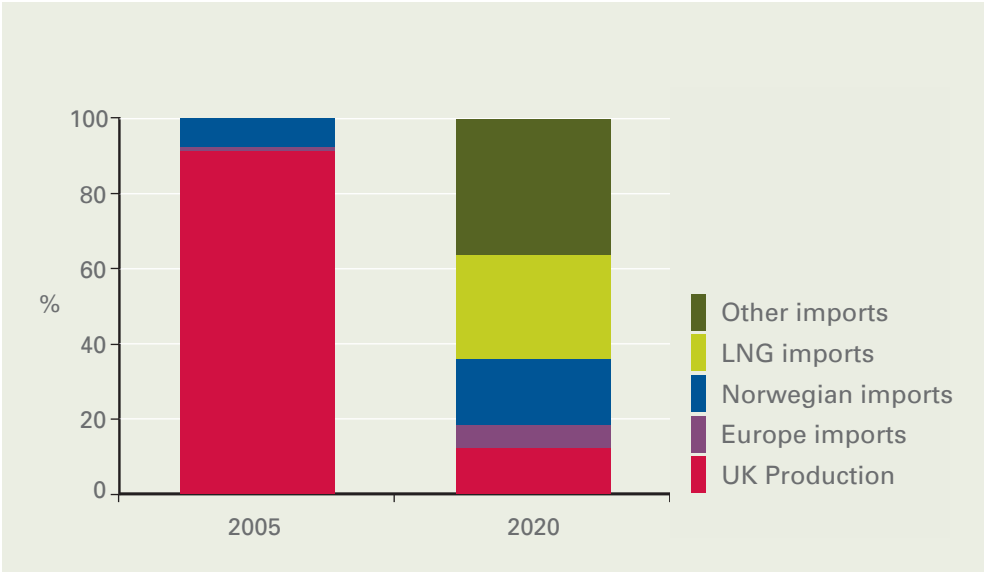
Managing the risks associated with energy imports

4.29 We have already outlined our international energy strategy in the section above. This is an important part of managing the risks associated with our increasing reliance on imported energy. But we must also consider whether our domestic energy market framework creates the right incentives for a sufficient and timely response to our need for more imported energy. We want incentives that deliver the new investment required in energy infrastructure (e.g. pipelines) and sufficient security (e.g. through storage).

4.30 We have long been importers of oil and coal and the infrastructure and markets to support this are well developed. Oil and coal are traded in global markets capable of adjusting to changes in demand and supply. And they are easy to transport and store. There were roughly 15 million tonnes of coal stocks at the end of 2005, equivalent to a quarter of annual demand. Emergency oil stocking arrangements are provided through the IEA and EU. However, the Government needs to continue to ensure that future legislation and targets (e.g. on air quality, carbon emissions and renewable fuels) which affect the domestic oil supply chain are informed by an understanding about the long-term impact on likely investment, the supply of fuels and prices to consumers.

4.31 It is in gas that the biggest changes are needed; we are moving from a position of virtual self-sufficiency to, by 2020, being 80 – 90% reliant on imports (see chart 13). While worldwide Liquefied Natural Gas (LNG) supplies and import capacity are forecast to double between 2005 and 2010, long-term contracts, limited liquidity in the market and shipping distances mean that gas is largely supplied into regional markets. Gas supplies could also be constrained by access to pipelines which cross many countries. In the future, however, a stronger global market for LNG might develop (see box 4.2). As a fuel, gas is more complex and more costly to store than coal or oil and there are currently no international arrangements to manage disruption to supplies, unlike in oil.

CHART 13. UK GAS IMPORTS 2005 AND 2020



Source: Wood Mackenzie, 2004

4.32 There are a number of trends affecting the UK gas industry over the next two decades. Some will have positive, and others will potentially have negative, implications for security of supply. The large amount of new gas import and storage capacity planned and being developed over the next few years should ensure a comfortable margin of 'spare capacity' over expected winter peak demand[37]. The projects should also help increase the diversity of sources and physical infrastructure (e.g. supply routes) to deliver gas to the UK. At the same time, increasing dependence on imports from or through markets that are further afield and which are not always open and competitive can increase the risk of price volatility and reduce supply reliability. However, there is a risk that any new infrastructure required after the successful delivery of the current wave of investment might not be added in a timely manner, which risks creating imbalances between supply and demand.

4.33 This risk of 'tightness' in the balance between demand and supply could lead to relatively high and volatile prices, which could have a considerable impact on the economy. In fact, if new infrastructure is not forthcoming or is delayed, there is a risk of price rises, costing consumers hundreds of millions of pounds. For example, a 1p/therm increase in price on a winter day adds approximately £1 million to the wholesale cost of gas; over a winter this might equate to some £200 million.

4.34 To minimise these risks we need to ensure that new infrastructure comes on stream in a timely fashion to enable us to bring more gas to the UK, but we also need a more flexible market, for example through the provision of more storage capacity located close to the market, and greater flexibility on the part of energy users to cope with demand and supply fluctuations.

4.35 We believe that well-functioning markets are the best mechanism to achieve this. However, we need to ensure that the market can bring forward

37 Under IEA stocking obligations arrangements the UK currently holds 67 days of consumption in stocks

new infrastructure without delay and develop sufficient flexibility. This is necessary to meet the challenges of a longer supply chain for gas and to manage supply and demand side risks.

4.36 Recent market developments illustrate that the market is responding to the changing pattern of supply. Some £10 billion of private sector investment is planned over the next few years, both in terms of new pipelines, new LNG import terminals and new storage projects, which could deliver approximately 100 billion cubic meters or more by 2015 assuming all projects are completed – a level sufficient to meet our forecast gas import requirements. Our first priority should be to help ensure that these projects are delivered.

Table 4.2: Planned gas imports infrastructure

Projects	Date	Max capacity
Langeled South	2006/07	70 mcm/day
Statfjord Late Life	2007/08	17 mcm/day
Expansion Interconnector	2006 (December)	from 44 to 66 mcm/day
BBL	2006 (December)	44 mcm/day
Expansion Isle of Grain	2008 (Q4)	25 mcm/day
South Hook LNG	2007 (2009)	33 mcm/day (26 mcm/day)
Dragon LNG	2007 (Q4)	27 mcm/day
Teesside LNG	under consideration	under consideration
Canvey Island LNG	under consideration	under consideration

Source: JESS, 2006

Table 4.3: Planned gas storage projects

Projects	Date of commissioning	Capacity
Aldbrough storage	Q3 2007	420 mcm
Holford storage	2008 (proposed)	170 mcm
Welton storage	2008	435 mcm
Preesall storage	2009 (proposed)	1,700 mcm
Aldbury (Phase 1)	2007/08 (proposed)	160 mcm
Aldbury (Phase 2)	2010 (proposed)	715 mcm
Bletchingley	2009 (proposed)	900 mcm
Saltfleetby	2008	600 mcm
Caythorpe	2007	210 mcm

Source: JESS, 2006

4.37 Securing planning consent is a key factor in the timely delivery of such projects. We need a regulatory and planning regime that is fit for purpose and minimises risks and uncertainties for developers. However, currently, investors are faced by a mix of local planning controls overseen by the Department for Communities and Local Government and specialist consent regimes administered by the Department of Trade and Industry. These regimes have evolved over time in a piecemeal fashion and are not designed to reflect the major changes in the UK gas industry, nor the technological developments in this area.

4.38 Government will consult in autumn on the streamlining and simplification of the planning process for gas supply infrastructure projects. This is in line with the commitments made by the Secretary of State for Trade and Industry earlier this year. More details for our proposals in this area are set out in Chapter 7.

4.39 Given the scale of the change we will see in energy markets over the next few decades, particularly in gas, it is important that Government, suppliers and consumers base their decisions on credible transparent information. For this reason the Government will introduce new arrangements for the provision of forward-looking energy market information and analysis relating to security of supply. Led from the DTI and working with key energy market players, the objective will be to brigade in one place relevant data and analysis on the medium- and long-term adequacy of future energy supplies to assist energy market participants with their investment and purchasing decisions and to help early identification of areas where policy may need to be reviewed.

4.40 Increasing the level of insurance against supply interruptions, for example through increased storage capacity or distillate oil back-up tanks, adds costs to the system. It is not affordable to ensure our energy system is 100% reliable, 100% of the time.

4.41 We have considered the merits of strategic storage (see box 4.3) and concluded that, while strategic storage could reduce the likelihood of an involuntary gas supply interruption, this is unlikely to be an issue before the middle of the next decade. Moreover, any intervention carries costs (in the order of £2 billion for a 'strategic store' the size of the existing Rough storage facility in the North Sea) along with the risk of unintended consequences. The latter could be particularly detrimental in the case of strategic storage, undermining the very objective of the policy: by creating the option for the Government to 'release' gas into the market in case of a shortfall, we would dull the incentive for private sector companies to invest in more storage or other kinds of flexibility. The end result could be increased costs with a net-reduction – not increase – in security of supply, if, for example, projects that otherwise would be coming forward, were deterred.

BOX 4.3: GAS STORAGE

The UK is becoming increasingly gas import-dependent, and our ability, during periods of high demand (e.g. winter), to rely on additional, flexible supply from gas fields in the UK North Sea is reducing as production declines. It is clear that gas storage – and other forms of flexibility, such as the ability for electricity generators to switch from gas to alternative fuels – is going to play a key role in managing fluctuations in the amount of gas supply available and the level of demand, both from season to season and from day to day. We have therefore commissioned detailed analysis[38] of the risks to UK gas security of supply in the next 10 – 15 years and an examination of the costs and benefits of developing 'strategic gas storage'. As with any modelling exercise, it was not possible to capture all of the complexities of the gas market. However, the findings of the modelling (summarised below) are broadly consistent with views expressed by industry participants as part of the Energy Review consultation.

The risks to UK gas security of supply over the next two decades were analysed to calculate the level of risk of an involuntary supply interruption. The work showed the probability of an interruption between 2008 – 2014 to be minimal; the planned large expansion in gas supply infrastructure over this period provides substantial flexibility in sourcing supplies. After 2014 it estimated a 1-2% chance of a significant supply interruption. Despite such a low probability that gas supplies will be interrupted, the costs to the economy of such an interruption could be very high. The loss of gas supplies to energy intensive industry has both direct and indirect effects on suppliers to and customers of the affected businesses.

In this context, after around 2015, the model indicates that it is possible that the level of spare gas supply capacity could again become tight for UK consumers. While the probability of this leading to involuntary interruptions of gas supplies would likely remain very small, the costs of any shortfall to British industry and economy as a whole could be substantial. If companies fail to invest to protect themselves (and any customers they have committed to delivering gas to) against such low-probability events (e.g. through additional gas storage or fuel back-up), there might be a case for Government intervention, such as obligatory 'strategic storage'.

4.42 The market is currently responding to need, as illustrated by the recent investments in storage and infrastructure. Any further consideration on strategic storage would likely be seen in an European and international context, particularly following recent developments, for example the 2006 EU Energy Green Paper or the international response to world shortages like Hurricane Katrina.

4.43 The aim should be to ensure our framework encourages industry to keep risks to a minimum and to do this in the most cost effective way. As we move away from self-sufficiency, it seems timely to engage with industry and

38 **Ilex Consulting,** *Strategic storage and other options to ensure long-term gas security*, 2006

consumers to assess the appropriate level of security of supply and the appropriate mechanisms to deliver it. Government will consult in the Autumn with both industry and consumers on the effectiveness of current gas security of supply arrangements, their robustness as we move to higher dependence on gas imports, and whether new measures are needed to strengthen them.

4.44 The consultation will consider the case for additional options, which could deliver increased market flexibility. This could be achieved through any of:

- changes in suppliers obligations, which could lead to an increase in the level of storage capacity;
- incentives for more gas and electricity demand side response, so that consumers reduce their gas demand when the system is under most strain;
- measures to incentivise distillate back up for gas-fired plants, which would encourage provision of distillate tanks enabling the release of gas to the market in case of tightness without jeopardising electricity security of supply.

Oil, Gas and Coal Proposals

- **Our international energy security strategy will be reviewed later this year and will focus on the following outcomes:**
  - **open international energy markets framework**
  - **Transparency and good governance in the energy sector**
  - **effective international contingency arrangements to guard against physical supply shocks in world oil markets.**
  - **Political and economic stability in source and transit regions.**
- **Government will work with industry to boost investment in the UK Continental Shelf (UKCS) over the next 10 to 15 years irrespective of oil and gas prices:**
  - **Maximising investment in already producing fields.**
  - **Establishing a Taskforce for meeting infrastructure needs to the west of Shetland.**
  - **Supporting the development of a dynamic commercial framework.**
  - **Ensuring appropriate technological development.**
- **The Government will be convening a Coal Forum to bring together coal producers, coal-fired generators and other interested parties to help them to find solutions to secure the long-term future of coal-fired generation and UK coal production.**
- **Government will consult in autumn on the streamlining and simplification of the planning process for gas supply infrastructure projects.**
- **Government will introduce new arrangements for the provision of forward-looking energy market information and analysis relating to security of supply.**
- **Government will consult in the autumn with both industry and consumers on the effectiveness of current gas security of supply arrangements.**

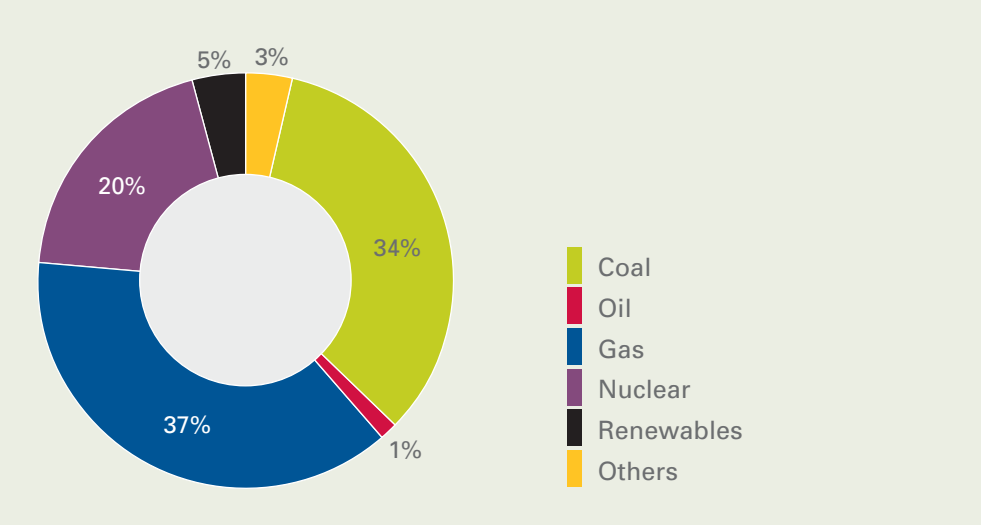
CHAPTER 5

Electricity Generation

The UK currently benefits from a diverse electricity generation mix; 37% is generated by gas-fired power stations, 34% from coal, 20% from nuclear, 5% from renewables and the remainder from other sources (chart 14). This diverse generation mix reduces the UK's dependency on a single fuel type and helps maintain a secure supply of electricity.

Over the next two decades, the UK will need substantial new investment in electricity generation capacity to replace closing coal, oil and nuclear power stations and to meet expected growth in electricity demand. Around 8GW (roughly a third of current capacity) of the UK's coal power stations must close no later than 2015 as a result of EU environmental legislation. And, based on published lifetimes, more than 10GW of the UK's nuclear power stations will close by 2023. In total, the UK is likely to need around 25GW of new electricity generation capacity by 2025, equivalent to more than 30% of today's existing capacity.

CHART 14. UK ELECTRICITY GENERATION MIX (2005)



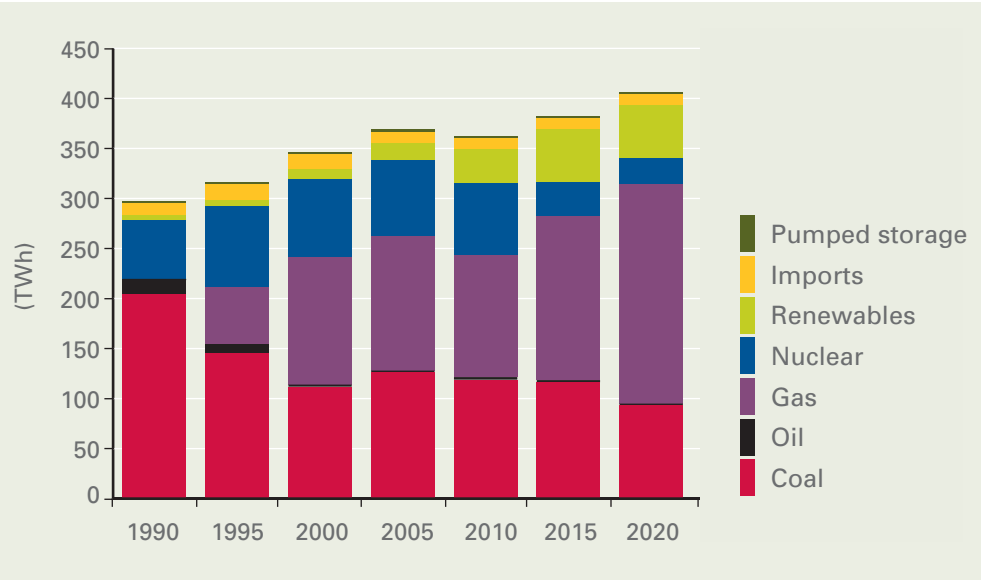
Source: DTI, 2006

5.1 It will be for private sector companies to make the necessary investment decisions within the regulatory framework set by the Government. We need to ensure that this framework provides the right incentives for adequate and

timely investment, consistent with our goal of moving to a low carbon economy. In this context, there are risks in the current outlook, but also opportunities.

5.2 Government's latest energy projections[39] based on a central set of assumptions show that, without changes to the current market framework, many of the closing coal and nuclear power stations would be replaced by gas-fired stations, along with some renewables (see chart 15). Under this scenario, the percentage of the UK's electricity supplied by gas-fired power stations could rise from 37% today to around 55% by 2020. This would reduce the diversity of the UK's generation mix, with more than half of the UK's electricity supply dependent on a single fuel type. This increased dependency on gas for electricity generation would also be happening at the very time the UK becomes increasingly reliant on imports for its gas supplies.

CHART 15. ELECTRICITY GENERATION MIX – PROJECTIONS TO 2020



Source: DTI, 2006

5.3 There are also implications for UK carbon emissions. Unless cost-effective technology to reduce carbon emissions in electricity generation comes forward, for every new fossil fuel-based station, there is a risk of locking in higher levels of carbon emissions for the 20-40 years that these power stations operate.

5.4 Finally, new investment must be timely. If new power stations do not come on stream in a pattern consistent with the expected closure rates of coal and nuclear power stations, the supply of electricity may only just able to meet demand during times of very high demand (e.g. at certain times of the day during winter). During these periods, businesses could face higher electricity prices. These periods of 'tightness' between supply and demand might result if new power stations are delayed in the planning system so that they do not begin operation as early as expected, potentially compromising security of supply. It could equally occur if existing power stations close

39 See Annex C.

earlier than is currently expected. However, our analysis indicates that based on existing UK capacity and the current expected pattern of power station closure, we are unlikely to face such risks before the middle of the next decade (see box 5.1). There is plenty of time for the market to respond to these developments with new investment. In addition, the proposals we make in this report to clarify the policy position on renewables and nuclear, and the commitment to a long term carbon market and to improve the planning regime should reduce uncertainty for investors and make it easier for companies to respond with new investment in a timely manner.

BOX 5.1: INVESTMENT IN NEW ELECTRICITY GENERATION CAPACITY

It is likely we will need up to 25GW of new generating capacity over the next two decades, to fill the 'generation gap' left by closing coal and nuclear stations and to meet future electricity demand. Given the scale of this challenge, the Review has undertaken detailed work to analyse the risks this could pose to our security of supply and to look at the cost-effectiveness of a number policy options[40]. The options investigated included different market-based mechanisms to encourage new build in a diverse set of generating technologies.

The analysis highlighted some risks around the market's ability to continue to deliver consistently the very high levels of security of supply UK consumers and businesses have been used to. The level of risk will depend on a number of factors including expected fossil fuel prices, the growth in electricity demand and the expected pattern of closure of existing coal power stations and nuclear power stations. The closure of coal stations will depend on individual company decisions, with stations that are not compliant with EU environmental legislation likely to close sometime after 2012 and certainly by 2015 when the EU legislation bites. The closure dates for nuclear stations will depend on whether some successfully achieve life extensions. The modelling suggests that if closure dates coincide, market participants may not be able to respond by developing and commissioning new power stations in a timely fashion. Under certain scenarios, this could lead to a reduction in the amount of spare capacity on the system to meet peak demand (e.g. demand at certain times of the day during winter). At the same time, it is important to recognise that this is a modelling exercise and as well as not being a perfect predictor of the future, the model does not take account of our proposals to clarify the Government's position on renewables and nuclear and to streamline planning, all of which should help ensure the market brings forward new investment in a timely manner.

However, the modelling also indicates that in most scenarios, the risk of having unserved electricity demand is unlikely to become substantively higher than today until around 2015. Even then, the amounts of 'shortfall' between demand and supply would likely be small and could therefore potentially be resolved by some companies voluntarily shifting their use from peak to off-peak times in response to price signals.

40 Redpoint Energy, Dynamics of UK Electricity Generation Investment, 2006.

Furthermore, the modelling showed that any intervention – such as a capacity mechanism – would impose significant costs and some risks on the system and, ultimately, the final consumer. The modelling indicates that while the policy options analysed can be effective in trying to address the issues identified around capacity shortfall, they can have unintended and often undesirable side-effects, such as further volatility in prices or higher carbon dioxide emissions. Such side-effects have indeed been one of the issues identified in markets elsewhere that have implemented capacity type mechanisms.

5.5 In analysing these risks and possible policy responses to address them we judge that, while recognising the risks associated with our existing market framework, the case for intervention on grounds of security of supply has not been made. This is especially true given our understanding that the system appears very robust to fluctuations in supply and demand under most scenarios at least until around 2015. We anticipate that, through the enhanced information provision arrangements for security of supply, the Government will be in a position to monitor the development of this market effectively to ensure that the framework continues to deliver. In addition, the proposals we make in this report to clarify the policy position on renewables and nuclear, the commitment to a long-term carbon market and to improve the planning regime should reduce uncertainty for investors and make it easier for companies to respond with new investment in a timely manner.

5.6 The opportunity is clear. Enabling an increase in new investment in low carbon electricity generation over the coming period, will lock-in lower levels of carbon emissions in our electricity sector for 20-40 years. Moreover, increasing the proportion of low carbon electricity generation will increase the diversity of the UK's electricity generation mix and could decrease the UK's dependency on imported gas.

Government sets the framework and companies make the investments

5.7 Government needs to ensure that the market framework enables companies to make timely investments consistent with the Government's policy goals on climate change and security of energy supplies.

5.8 Companies need a market and regulatory framework that provides clarity and helps reduce uncertainty. The policy proposals for electricity generation are aimed at reducing uncertainty, incentivising investment in low carbon technologies and improving market information.

Reducing policy uncertainty

5.9 Given the long-term nature of investments in electricity generation, policy uncertainty creates a barrier to new investment. Policy uncertainty affects the economics of all new power stations, by raising the cost of the capital companies need to borrow to make new investments. It can disproportionately affect technologies that require higher levels of upfront capital investment, such as low carbon technologies. Submissions to the Energy Review consultation particularly emphasised the need for clarity on the Government's future policy direction on renewables and on nuclear. Therefore, in the following sections of this report, we will:

- Confirm and strengthen our commitment to the Renewables Obligation; and
- Clarify our position on new nuclear build.

Reducing regulatory uncertainty

5.10 Another area of concern highlighted during the Energy Review consultation was the need to improve the planning process for all energy infrastructure. Uncertainties and delays caused by the existing planning process increase the likelihood that investments in new power stations (and other energy infrastructure such as gas storage) will not be timely. Proposals to improve the planning process for large-scale electricity generation are set out in a separate planning chapter. The proposed improvements should help in two ways:

- They should provide more certainty as to the timescales for any given planning inquiry; and
- They should shorten the overall timescales from application to a final decision on consent.

5.11 These proposals should help to incentivise investments in all forms of electricity generation, including low carbon technologies. More details can be found in chapter 7.

Sending a strong signal about the value of low carbon investment

5.12 In Chapter 1, we set out our aim to strengthen the EU Emissions Trading Scheme (EU ETS) post-2012 so that it provides a stable and transparent investment framework for business. The UK remains committed to a carbon price signal; a credible and continuing carbon price is crucial for sending a strong signal to companies about the need for low carbon generation. The EU ETS is here to stay beyond 2012 and will remain the key mechanism for providing this signal, and Government will continue to work with our international partners to strengthen the Scheme to make it more effective. We will keep open the option of further measures to reinforce the operation of the EU ETS in the UK if this should be necessary to provide greater certainty to investors

Improving the quality of forward looking market information

5.13 Companies will need to buy their electricity over the next 10-15 years against a background of many uncertainties in the electricity market. Companies wishing to invest in new power stations will face these same uncertainties. To mention just a few of these:

- it is likely that the long term average prices of fossil fuels will be higher in the UK than over the previous decade but neither companies nor Government can know how future prices might evolve. The future price of fossil fuels will affect the price of the electricity we buy;
- the exact pattern and timing of closures of coal and nuclear power stations is uncertain and as mentioned, the pattern of closure and new investment will affect electricity prices; and
- given the multilateral nature of the EU ETS, neither Government nor companies can be sure the pace at which this scheme will evolve.

5.14 Against this background of uncertainties, Government believes there is a strong case for improving the quality and dissemination of forward looking market information for companies and investors. There was strong support for improved information in the submissions to the Energy Review Consultation. As we have already set out for gas, Government will introduce new arrangements for the provision of forward-looking energy market information and analysis relating to security of supply. Led from the DTI and working with key energy market players, the objective will be to brigade in one place relevant data and analysis on the medium and long term adequacy of future energy supplies to help early identification of areas where policy may need to be reviewed and to assist energy market participants with their investment and purchasing decisions.

5.15 In the following sections, we set out our proposals on different forms of electricity generation: renewables, cleaner coal and carbon capture and storage and nuclear.

Summary of Proposals relating to Electricity Generation

Government will:

- **confirm and strengthen our commitment to the Renewables Obligation;**
- **clarify its position on new nuclear build;**
- **bring forward proposals to improve the planning process for large-scale electricity generation – these are set out in a separate planning chapter;**
- **set out our aim to strengthen the EU Emissions Trading Scheme (ETS) post-2012 so that it provides a stable and transparent investment framework for business. This is covered in more detail in chapter 1; and**
- **introduce new arrangements for the provision of forward-looking energy market information and analysis relating to security of supply.**

Electricity Generation – Renewables

Renewable energy, derived from sources such as the sun, the wind, waves, tides and biomass (including waste), is a vital and growing component of our diverse energy mix. If we could derive more of our energy from the renewable sources all around us, we could reduce our reliance on imported fossil fuels. And as renewable energy produces very little carbon or other greenhouse gases, it helps us cut emissions, and plays an important part in tackling climate change.

The Government therefore proposes to strengthen the framework that supports the development and deployment of renewable technologies. With this strategy, the Government believes that we can achieve 20% of our electricity coming from renewable sources by 2020.

Background

5.16 Energy flows all around us in the environment. The wind, waves and tides, driven by the power of the sun, or the gravitational effects of the sun and the moon, are essentially inexhaustible sources that we can harness to meet some of our energy needs. We can also use the crops that we grow and some of the waste that we generate.

5.17 Renewable energy is an integral part of the Government's long-term aim of reducing CO_2 emissions by 60% by 2050. As it produces very little carbon dioxide and other greenhouse gases, it plays an important part in tackling climate change.

5.18 Further, if we can increase the amount of energy we get from the renewable sources around us, we can reduce our dependence on imported fossil fuels. In this way, the extra diversity that renewables bring to the UK's energy infrastructure can make a significant contribution to the Government's goal of ensuring secure and reliable energy supplies.

5.19 The UK is naturally endowed with very favourable resources of renewable energy – especially onshore and offshore wind – and there is the potential for the UK to be a world-leader in emerging renewable technologies.

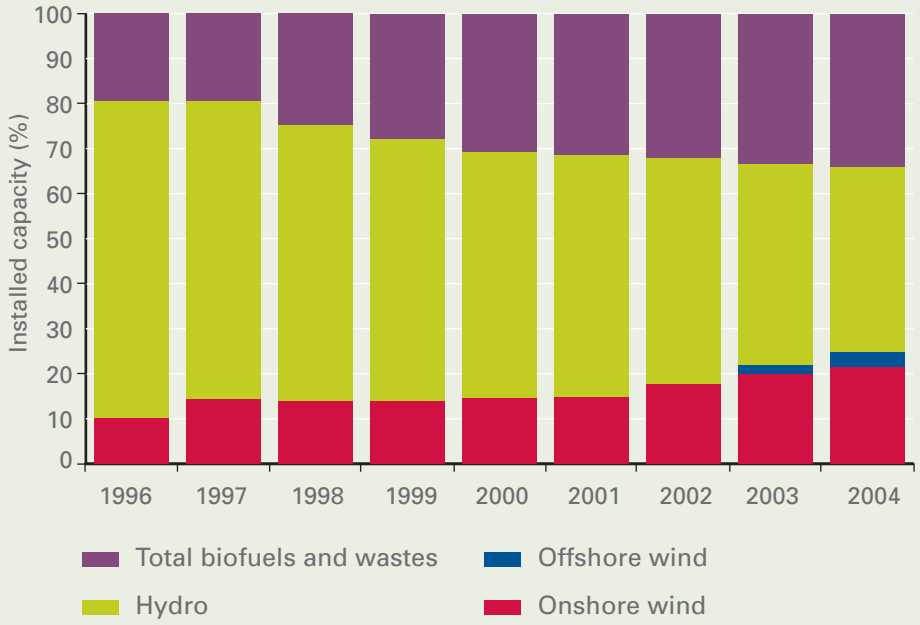
5.20 Recognising the important contribution that renewable forms of energy can make to our energy policy goals, in the 2003 Energy White Paper Government set a target of 10% of electricity supply from renewable energy by 2010, subject to the costs being acceptable to the consumer, with a further aspiration to derive 20% of our electricity from renewable sources by 2020.

5.21 To help achieve this, the Government has introduced a number of measures to incentivise the development and deployment of renewable sources of energy in the UK, including the Renewables Obligation (RO) and some £500m of public funding for various support programmes.

5.22 As a result, the amount of UK renewable electricity generation has increased substantially since 2002. Total generation from RO-eligible renewable sources was around 4% of total electricity supplied to UK consumers in 2005, up from 1.8% in 2002.

5.23 About 1.7 GW of wind power is now connected to the grid, enough to supply power to almost one million homes[41]. Chart 16 below indicates that energy from biofuels and waste and from onshore and offshore wind continue to provide a growing proportion of overall supplies of energy from renewable sources. There are also a significant number of projects currently in the planning pipeline, with over 11GW[42] of renewable projects in planning across the UK.

CHART 16. THE CONTRIBUTION OF DIFFERENT TECHNOLOGIES TO THE UK'S OVERALL ELECTRICITY GENERATION FROM RENEWABLE SOURCES



Source: DTI, 2005

5.24 However, without further action and greater long-term certainty for investors, the recent growth in renewables generation may slow between 2010 and 2020. This is because the growth in more established technologies is likely to be constrained – by scarcity of suitable sites in the case of hydroelectric power and landfill gas, and by planning requirements and delays in getting grid connections in the case of onshore wind. The growth of emerging technologies is currently constrained by their relative cost. For example, offshore wind, which was expected to make a substantial contribution to the Government's 10% target and 20% aspiration, is currently proving more expensive than anticipated. This is due, for example, to rising steel prices and increasing global demand for turbines.

41 British Wind Energy Association – www.bwea.com
42 Renewable Energy Statistics Database – http://www.restats.org.uk/2010_target.html

5.25 If we are to achieve 20% of electricity from renewable sources by 2020, then both onshore and offshore wind will need to make a significant contribution. We will also need to maximise the potential contribution from other technologies, established and emerging alike, such as landfill gas (including energy from waste – see box 5.3), biomass, hydroelectric power and wave and tidal stream (see box 5.2). Therefore, the Government has considered three main areas for further enabling the development and deployment of renewable energy in the UK:

- strengthening and modifying the Renewables Obligation to provide longer-term certainty and create a greater incentive for investment into those technologies that are further from the market;
- attempting to accelerate access to the electricity grid for renewable electricity generators; and
- tackling planning barriers to reduce delays and uncertainty for developers.

BOX 5.2: TIDAL IMPOUNDMENT SCHEMES

Tidal impoundment schemes – such as barrages and lagoons – and tidal current technologies have the potential to make a significant contribution to carbon reductions. In common with other power generation projects they could bring with them a number of external benefits, but generally are not competitive with other forms of low carbon generation.

During the course of consultation we have received a range of views on tidal generation, in particular on the plans for a Severn Barrage, which could provide around 5% of current UK electricity demand by 2020. This could cost in the region of £14 billion. It is clear that while attractive in terms of energy generation and associated benefits, plans for a Severn Barrage would raise strong environmental concerns in view of the designations that apply to the Severn Estuary.

We are however interested in improving our understanding of how to make best use of the potential tidal resource in UK waters. Together with the Welsh Assembly Government, we will therefore work with the Sustainable Development Commission, the South West Regional Development Agency and other key interested parties to explore the issues arising on the tidal resource in the UK, including the Severn Estuary, including potential costs and benefits of developments using the range of tidal technologies and their public acceptability.

Strengthening and Modifying the Renewables Obligation

5.26 The Renewables Obligation (RO) is the Government's main support mechanism for the expansion of renewable electricity in the UK. Introduced in 2002, the RO obliges electricity suppliers to source a rising percentage of electricity from renewable sources.

5.27 The level of the obligation is 6.7% in 2006/07. Under current policy, it would rise annually to 15.4% in 2015/16, then remain at that level until the obligation ceases in 2027.

5.28 In order to meet their obligation, energy suppliers must prove they have

purchased energy from renewable sources by presenting Renewables Obligation Certificates (ROCs), or, alternatively, by making a fixed financial payment (a "buyout price"), or some combination of the two. The "buyout price" rises in line with inflation each year. It caps the costs of the obligation to suppliers and, in turn, consumers.

5.29 The RO was designed to incentivise the most economic forms of renewable generation. Since its introduction, it has been effective in achieving this and has stimulated significant development of onshore wind, co-firing and landfill gas. However, more could be done to drive further innovation and bring forward significant growth in renewable microgeneration technologies. To achieve the step change we need in the share of our energy from renewables, these emerging technologies need to be strongly fostered.

5.30 We have identified the following three steps for strengthening and widening the impact of the RO:

- extending Obligation levels to 20% (when justified by growth in renewable generation);
- amending the RO to remove risk of unanticipated ROC oversupply; and
- adapting the RO to provide greater support to emerging technologies and less support for established technologies. The Government's preferred option for achieving this is through a "banding" system, ensuring that current ROC rights for existing projects and for those built prior to implementation of changes are preserved. Any changes would be introduced in 2010.

5.31 We shall consult fully on the second and third of these proposals and on the implementation of the first.

5.32 In introducing "banding", the Government would preserve current ROC rights for existing projects and for those built prior to implementation of changes. We envisage the change would be introduced in 2009 or 2010.

5.33 The Government announced in March 2006 that it would look again at the role of co-firing within the RO as part of the Energy Review. We believe that co-firing could play a greater role in contributing to our renewable energy and carbon reduction targets with reduced levels of support and we will be consulting on changes to the co-firing rules.

5.34 With this strategy, the Government believes that it is achievable to have 20% of electricity coming from renewable sources by 2020.

Obligation levels

5.35 In considering options for amending the RO to ensure it continues to meet our policy goals, the Government recognises that it is essential to maintain investor confidence. For this reason, the Government is committed to existing decisions on Obligation levels. The additional announcements detailed below aim to deliver long-term ROC price certainty beyond 2015/16 and through the remaining life of the Obligation to 2027.

5.36 The Government is also committed to ensuring the costs to consumers associated with the Obligation are acceptable. Therefore, the commitment to extend Obligation levels to 20% will be made cost neutral by freezing the ROC buyout price from 2015.

5.37 Overall, this measure involves the following elements:

- the Government commits to maintaining Obligation levels above the level of ROC-eligible renewable generation, to a maximum level of 20% of generation from renewable sources. Increases in Obligation levels above 15.4% will not occur at pre-determined stages, as with existing announcements, but will follow a "guaranteed headroom" model, where increases are contingent upon appropriate levels of growth in renewables generation;
- the Government will remove the automatic annual increase of the buyout price in line with inflation from 2015. The overall package of measures will be approximately cost-neutral to the consumer; and
- the Government will consult on measures to amend the RO such that any renewable generation exceeding the level of the Obligation would not have a precipitate impact on ROC prices, but rather taper gradually downwards.

Banding the Renewables Obligation

5.38 The Government has considered carefully a number of options proposed by respondents to the Energy Review consultation to modify the RO. Of these, we believe "banding" – whereby emerging technologies are awarded more ROCs per MWh of electricity generated than other technologies – would best deliver the Government's aims of:

- bringing forward emerging renewable technologies;
- improving the overall cost-effectiveness of the RO; and
- preserving investor confidence by applying changes only to new projects (i.e. "grandfathering" existing projects).

5.39 We therefore intend to consult on whether and how to move to banding the RO. If the Government decides to band the RO following the consultation, we will seek to introduce the necessary primary legislation in time for changes to be implemented to the Renewables Obligation Order in 2009 or 2010. This is subject to identification of a suitable legislative vehicle, passage of the legislation through Parliament and state aid approval from the European Commission.

5.40 Banding the RO would mean giving some technologies more ROCs and others less ROCs. In order to preserve ROC market stability, the Government will seek to balance these factors – so that the number of ROCs in the market does not significantly alter as a result of the change.

5.41 The DTI, the Scottish Executive and the Department of Enterprise, Trade and Investment in Northern Ireland are committed to maintaining a strong UK-wide ROC market, operating on a consistent basis, and will work together to ensure that this is delivered. This includes liaising with the Scottish Executive to promote complementarity with their current proposals for prioritising support to marine energy.

Reasonable notice and grandfathering

5.42 Changes to ROC eligibility rights will be introduced only after a reasonable notice period. The position of existing projects will be protected.

5.43 If the RO is banded, existing projects will be "grandfathered" – all projects operational now (i.e. that have been commissioned and are generating electricity) will continue to be entitled to one ROC per MWh for the remaining lifetime of the Obligation.

5.44 For projects which become operational after this announcement but prior to possible banding, the support they receive through the RO will depend on the technology used. Projects in more economic technologies that may have their number of ROCs reduced (such as landfill gas and potentially onshore wind) will remain entitled to one ROC per MWh for the remaining life of the Obligation. Projects in emerging technologies that may have their number of ROCs increased (such as offshore wind, marine and photovoltaics) will receive one ROC per MWh until the banding comes into effect, at which point they will, as appropriate, be moved up to the new band for their technology and receive the new (higher) number of ROCs. The one exception to this may be emerging technology projects that receive capital grants from the Government – as these projects are given grants on the basis of the current level of support.

5.45 If the RO is banded, projects that become operational after this change comes into effect will receive the number of ROCs determined by their band. This value would not be reduced for the lifetime of the project, irrespective of subsequent changes. The position of projects and investors will therefore be protected.

Co-firing

5.46 When the RO was introduced, co-firing – the burning of biomass alongside fossil fuels – was included as a transitional technology to encourage the establishment of biomass supply chains, particularly energy crops. Co-firing was permitted up to a specified cap and, from a specified date, co-firers would need to use a certain minimum amount of energy crops to be eligible for ROCs. Within the context of the Energy Review, the Government conducted a review of co-firing. This review led to a broad consensus that co-firing should be encouraged to play a long-term role in reducing carbon emissions. However, co-firing is one of the most economic forms of renewable energy and does not need full support of the RO. If the price of carbon were sufficiently high, it might be possible that co-firing would require no support from the RO – although this is an option for the long term.

5.47 At the moment, and probably for the next decade or so, co-firing is likely to continue to require the support of the RO. So, if the RO is banded, co-firing will be designated a band. This will be less than one ROC per MWh, but the cap on the total volume of co-firing will be removed. Unlike other technologies, however, there will be no grandfathering for co-firing – as it requires relatively little capital expenditure.

5.48 The Government believes there is a case to continue to support UK energy crops. One option under a banded RO would be to allocate energy crops a higher band. In order to ensure that the UK's energy crop market can continue to develop between this announcement and the possible introduction of banding, the Government will consult on an interim change to the co-firing rules – allowing the co-firing of energy crops outside the existing caps on co-firing.

5.49 If the RO is not banded, a cap on co-firing is likely to continue. The Government would consult as to whether the current cap and restrictions are still appropriate.

BOX 5.3: ENERGY FROM WASTE

The Government's waste policy prioritises prevention, reuse and recycling over the recovery of energy from residual wastes. But where prevention, reuse and recycling are not possible, recovering energy from waste could contribute to our energy policy goal as a source of low carbon energy where the energy so generated comes from the biomass fraction of the waste (e.g. waste food), which is renewable; does not displace recycling, which is even more beneficial; and does displace fossil generation.

Strong opposition from some sections of the public has hindered the development of energy from waste technologies in the UK. This opposition is motivated primarily by fears over supposed impacts on human health, as well as by concerns that excessive investment in incineration, in particular, might "lock in" wastes which could otherwise have been recycled. The Government believes that the first of these concerns is not supported by the available evidence, whilst the second can be addressed through the careful design of local waste strategies. These issues are being addressed in the Government's revision of its waste strategy for England, which will be published towards the end of this year.

Next steps and timetable

5.50 The Government will launch a consultation on if and how the RO should be banded by this autumn. This will include consultation on how bands are set, how frequently bands are to be reviewed, the operation of the headroom approach to setting Obligation levels, the ROC price tapering mechanism, and changes to the co-firing rules.

Action on Grid Issues

5.51 Growth in future renewables requires connection to the electricity network. The anticipated geographical location of much of the new renewable generation that will be coming on stream, and of wind generation in particular, will require the development of new transmission infrastructure in parts of England, Wales and Scotland. Without the investment to link these renewables to the grid, we will not see the levels of renewables delivered that we want. Annex E discusses potential investment requirements to accommodate different amounts of generation.

5.52 The Government is aware of a number of significant and pressing issues that need resolution. These include current Final Sums Liability (FSL) arrangements and the "queue" created by the confluence of the Government's renewable targets, the Renewable Incentive Scheme and transitional arrangements for BETTA. Annex E discusses these in depth as well as a number of longer-term technical and regulatory issues.

5.53 It is vital to resolve these issues in order to maximise the potential of renewables and to achieve targets for their use. Ofgem and National Grid are working to resolve these issues through the Transmission Price Control Review and Access reform working groups. The Government will monitor these processes closely; it is crucial that they progress to a satisfactory conclusion.

5.54 The Government is also taking the following steps to promote electricity network access for renewables generators, explained and elaborated in Annex E. First, work sponsored by the DTI suggests that renewable generation may drive the need for transmission reinforcement to a lesser degree than conventional generation. In a cost-reflective pricing system such as ours, this would imply that transmission charges should be lowered for variable generating plant, such as wind.

5.55 We will work with Ofgem and National Grid, and in consultation with industry and relevant experts, to determine whether variable generation, particularly wind, drives network investment to a different degree than conventional generation and, if so, whether changes to the Security and Quality of Supply Standards for renewables as well as relevant investment and transmission charging methodologies are required.

5.56 The Government is concerned to ensure that current rules under BETTA relating to system security are not leading to unnecessary delays in the connection of renewable generation. We welcome Ofgem and National Grid working together with industry to consider the options for shared, temporary and limited access to the transmission system with a view to giving renewable generation priority.

5.57 The Government is also working with Ofgem and industry to develop an offshore transmission regime to connect offshore wind and future wave and tidal projects to the onshore grid. This is critical enabler for the development of the marine renewable sector. The aim is to have the regime in place by 2008.

Planning

5.58 The Government has identified a number of issues relating to the planning system for large energy infrastructure as a whole, and a set of proposals for addressing them. These are outlined in chapter 7.

5.59 The Government also recognises that there are specific issues relating to planning and renewable energy generation. For example, securing planning permission for renewables, and in particular onshore wind, can be an especially difficult process, with developers facing much uncertainty and a significant risk of delays. The Government proposes to tackle these planning issues with a view to reducing delays and uncertainties for developers and others. These proposals are outlined in more detail in chapter 7.

5.60 The Scottish Executive will implement an ambitious strategy for the deployment of renewables in Scotland and speeding up the consenting process, which has the potential to boost significantly the level of renewable generation by 2020.

Conclusions

5.61 The Government has also recently announced extra funding for renewables and other low carbon technologies from the Environmental Transformation Fund and further investments that will accelerate the contribution from microgeneration and distributed renewable generation. Taking all of these measures together, the Government believes that we can achieve 20% of our electricity coming from renewable sources by 2020.

Measures on Renewable Energy

In order to support the development and deployment of renewable technologies, the Government proposes to:

- **Strengthen and modify the Renewables Obligation (RO) to provide longer-term certainty and create a greater incentive for investment into those technologies that are further from the market.**

This will include:

- **extending Obligation levels to 20% (when justified by growth in renewable generation) – this will be made cost-neutral to the consumer by freezing the buyout price from 2015;**
- **consulting on amending the RO to remove risk of oversupply of ROCs;**
- **consulting on possible adjustments to the RO ("banding") to provide greater support to emerging technologies and reduced support for more established technologies;**
- **providing new funding for renewables through the Environmental Transformation Fund;**
- **working with industry, Ofgem and the National Grid to accelerate access to the electricity grid for renewable electricity generators; and**
- **working with the Devolved Administrations to ensure that across the UK, planning systems for renewables projects can reduce delays and uncertainty for developers and others, while maintaining the openness, fairness and accountability of the current system.**

Electricity – Cleaner Coal and Carbon Capture and Storage

5.62 For many decades electricity generated from coal-fired power stations has played a major part in meeting the UK's electricity needs. Even with the growing importance of gas in the generation mix, coal-fired generation continues to meet around a third of electricity demand on average and during the winter of 2005/2006, in response to high gas prices, it met about half of demand. This illustrates the important contribution made by coal fired generation to the UK's energy security and the flexibility of its energy system.

5.63 Generators have recognised the importance of coal in their generating portfolios and have committed significant investment to enable 20GW, or about two thirds, of existing coal-fired capacity to comply with the Large Combustion Plant Directives (LCPD), which restricts emissions of sulphur dioxide and nitrogen oxides.

5.64 Coal-fired generation will therefore continue to play an important role in the UK's energy system, provided that its environmental impact can be managed effectively. As Table 5.1 below shows, coal-fired generation is the most carbon intensive of the major forms of electricity generation, emitting, for example, considerably more carbon than gas-fired generation. This underlines the importance and urgency of reducing the environmental impact from coal-fired generation.

5.65 There are at present three main means of reducing the carbon emissions from coal-fired generation – improving the efficiency of power stations, co-firing coal with biomass, and carbon capture and storage. These technologies are sometimes known collectively as "cleaner coal". The Government is taking action in each of these areas.

Table 5.1: Illustrative annual carbon emissions from 500MW electricity generation plant[43]

Plant type	Carbon emissions (millions tonnes / year)
Conventional coal	0.90
Efficient coal	0.69-0.74
Efficient coal with biomass	0.60-65
Natural gas	0.36
Natural gas or efficient coal with carbon capture and storage	<0.10

5.66 There has been and continues to be significant improvement in the efficiency, and therefore the carbon emissions intensity, of coal-fired generation technology. Advanced boilers, improved turbines and gasifiers can increase efficiency of coal plant and reduce emissions by about 20%.

43 Source: DTI, 2006.

5.67 There is the potential to increase further the efficiency of coal-fired generation and thereby improve its environmental performance. This is an important component of the Carbon Abatement Technology (CAT) strategy,[44] which sets out the Government's approach to supporting the development of low carbon technologies for power generation. £25 million was initially allocated to support technology demonstration within the CAT strategy and this was supplemented by an additional £10 million in the 2005 Pre-Budget Report.

5.68 This CAT strategy demonstration programme will formally launch its first call for proposals in September 2006. The first call is worth £10 million and will focus on the pre-commercial demonstration of key components and systems to support carbon abatement technologies. Subject to state aid approval, later calls in the scheme for the remaining £25 million will focus on projects which involve the demonstration of carbon abatement technologies in operating power stations.

5.69 More efficient coal plant can also be combined with co-firing of biomass to decrease emissions by about 10%. Co-firing has been incentivised through the Renewables Obligation. The Government has looked again at the co-firing rules and more detail is set out in the renewables section of this chapter.

Carbon capture and storage (CCS)

5.70 Carbon capture and storage (CCS) involves capturing carbon from a process that produces carbon, such as the burning of fossil fuels, and transporting it to a site where it is stored underground in geological formations and thereby prevented from entering the atmosphere.

5.71 CCS might reduce the carbon emissions from the combustion of fossil fuels in electricity generation and industry by 80 to 90% relative to the same plant without CCS. CCS in conjunction with electricity generation offers particular promise. The world still is and will continue to be highly dependent on electricity generation from fossil fuels. In the UK, for example, fossil-fuel based generation accounts for about 70% of UK electricity supply and about 30% of the UK's carbon emissions. Further, rapidly developing economies such as China and India are meeting much of their increasing demand for electricity through coal-fired generation. So if CCS were economic and technically feasible on a large scale, it could have a major impact on global carbon emissions.

5.72 Each of the component parts of the CCS process is already in use in various places around the world, including in commercial settings, although the whole CCS process in conjunction with electricity generation has not yet been demonstrated on a commercial scale. For instance, at the Great Plains Synfuels Plant in North Dakota, carbon dioxide is captured in a commercial setting and transported by pipeline to Weyburn in Canada where it is used to increase the recovery of oil from an oil field. A project at the Sleipner gas field in the Norwegian North Sea stores about one million tonnes of carbon dioxide per annum in a deep saline aquifer. But neither of these projects involves electricity generation. Indeed, because the whole CCS process in conjunction with electricity generation has not yet been demonstrated on a commercial

44 *A Strategy for Developing Carbon Abatement Technologies for Fossil Fuel Use*, DTI, 2005.

scale, there remain uncertainties about some of the technical, environmental and economic aspects of CCS in such a setting.

5.73 CCS nevertheless has great potential as a means of reducing global carbon emissions. Further, the UK has a number of natural and commercial advantages in developing CCS, because of the skills to be found within its well established oil and gas industries, and the role that oil and gas fields in the North Sea might play in CCS storage. Before CCS can play a significant role in reducing carbon emissions, however, there are a number of challenging regulatory issues that need to be resolved, both at home and abroad. CCS also presents real and new challenges in terms of its economic feasibility.

5.74 In the UK and elsewhere a number of specific proposals for large-scale CCS projects in conjunction with electricity generation have been brought forward by potential operators. While many of these proposals are only at an early stage in their development, they reflect a growing interest in CCS technology on the part of potential generators.

Developing a regulatory framework for CCS

5.75 Before CCS can happen in the UK, a legal and regulatory framework needs to be established which would enable operators to bring forward CCS projects that are safe, that minimise potential environmental risks and that assign responsibilities appropriately between the public and private sectors.

5.76 The Government will continue to work with international partners to amend international legal frameworks to provide the legal basis for CCS. Storage beneath the seabed is particularly important to the UK because of the available capacity associated with depleted oil and gas reservoirs as well as deep saline aquifers. Such storage falls under the international agreement called the London Convention which exists to protect the marine environment through preventing the dumping of wastes in oceans and seas world-wide. While this prevents marine pollution, it creates uncertainty over what types of CCS projects with carbon dioxide storage in the marine area are legally allowed. The Government has pushed strongly to clarify these rules, and in April 2006 a draft amendment was prepared which would allow geological storage of carbon dioxide beneath the seabed. A separate international agreement, the OSPAR Convention, exists to provide further protection of the marine environment in the North East Atlantic. Signatories to the Convention have agreed to start work to clarify and if appropriate amend the Convention to facilitate subsea geological storage of carbon dioxide, and the Government is supporting this initiative.

5.77 There are also a range of complex regulatory issues at the domestic level that the Government is working to resolve. In 2006 a CCS Regulatory Task Force was established with membership from across the Government. The Task Force will clarify existing UK regulation and its application, identify the need for new regulation, and develop proposals for new regulation as required in the following areas:

- the licensing of carbon dioxide storage sites and activities offshore;
- decommissioning and long-term liabilities associated with storage facilities; and
- licensing and regulation of onshore facilities, including carbon capture, transport and storage and "capture-ready" plant.

5.78 The work of the CCS Regulatory Task Force will continue in consultation with industry and other stakeholders in order to clarify and develop proposals on appropriate regulations both to facilitate CCS and to ensure the environmental integrity of CCS activities. This should include an assessment of the issues relating to liability for carbon dioxide in geological storage, including in the longer-term. The Government will consider the best ways to consult as the Task Force's work progresses, including the option of a formal consultation covering all aspects of CCS regulation. Formal consultation on carbon dioxide storage in the marine environment already forms part of the Marine Bill consultation.

International cooperation

5.79 The UK has joined together with international partners to facilitate the adoption of CCS and to encourage its development in countries with rapidly growing energy needs.

5.80 The UK is working in partnership with Norway through the North Sea Basin Taskforce to develop, where appropriate, common principles for the regulation and management of carbon dioxide transport, injection and storage in the North Sea. The Taskforce is comprised of public and private organisations from both countries and will be reporting its conclusions to the UK and Norwegian Energy Ministers by 2007. As announced in the 2005 Pre-Budget report, the UK and Norway have also been working collaboratively on the issues surrounding the costs of CCS.

5.81 The development of CCS in the North Sea is likely to require a new infrastructure enabling the transport and storage of carbon dioxide. This is a big challenge and there will clearly be benefits in the coordinated international development of each element of CCS.

5.82 The Chancellor and the Norwegian Prime Minister announced in June 2006 a joint project on enabling CCS in the North Sea. This will include an examination of the likely future need for a physical infrastructure of pipelines, the advantages of and barriers to the development of such a potential network, and ways in which the benefits of CCS could be realised in the most efficient and cost-effective way. The project will also examine aspects of the international regulatory regime including the rules for CCS in the EU Emissions Trading Scheme (see below).

5.83 The UK is also working to encourage the development of CCS in countries with rapidly growing energy needs. As part of the UK's Presidency of the EU during 2005, the Government announced it was to take the lead in setting up an EU-China collaboration on CCS with China through the Near Zero Emissions Coal (NZEC) project which aims to demonstrate coal fired power generation with carbon capture and storage technology in China by 2020. The UK has funded and is leading on the first phase of the NZEC project. The UK is also actively exploring the potential for collaboration on CCS with the Government of India, which also has a rapidly expanding power generation sector highly dependent on coal.

Economics of CCS

5.84 While creating the legal and regulatory framework which would allow CCS projects to come forward is a necessary step in making CCS a reality, it is not in itself sufficient. CCS will only realise its potential if it is also technically feasible, environmentally sound and economically viable. The evidence available, including experience from existing projects involving the capture, transportation and storage of carbon, suggests that CCS is both technically feasible and, with suitable safeguards and appropriate choice of storage sites, involves an acceptable level of environmental risk. Further, studies[45] suggest that shortage of suitable sites for carbon storage is unlikely to be a significant constraint on CCS's potential to deliver carbon emissions reductions on a large scale. In the long run the most crucial issue for CCS may therefore be its economic and commercial feasibility.

5.85 The costs of CCS consist of both the costs of the capture technology and transport and storage infrastructure, and the process of capturing, transporting and storing carbon. Further, carbon capture imposes a significant reduction in the efficiency of the underlying electricity generation process. There remains significant uncertainty about the scale of some of these costs, in part because CCS has not yet been demonstrated on a commercial scale in conjunction with electricity generation. For CCS to be commercially feasible, where these costs are incurred by the owners of plant with CCS they must be offset by some benefits to the owners.

5.86 Depleted oil and gas fields in the North Sea are potential storage sites for carbon dioxide, and carbon dioxide can also be used to enhance oil recovery from oil fields that are still active. There may be scope for reuse of some of the oil and gas infrastructure in the North Sea for CCS. Following an announcement in the 2005 Pre-Budget Report, the Government has opened discussions with industry to examine structural issues for the North Sea fiscal regime. The discussions provide a useful vehicle for HM Treasury and HMRC to work with industry to consider ways in which greater certainty can be provided on how existing tax rules impact on the use of assets involved in energy production, in particular where assets have previously been used in oil and gas exploration and production activities.

5.87 A crucial step in bringing CCS closer to economic and commercial feasibility is ensuring that the environmental benefits that it secures are recognised and rewarded under schemes and policies designed to encourage carbon emissions reductions. This will help ensure that the environmental benefits of CCS are taken into account by generators when they make investment decisions.

5.88 Before this year it was not possible to include the impact of CCS on the quantity of emissions countries reported to the United Nations Framework Convention on Climate Change (UNFCCC). This meant that countries could not use CCS to help them meet their Kyoto targets. Through its work with the International Panel on Climate Change (IPCC) the Government has made a major contribution to the development of new guidelines on accounting for greenhouse gas emissions, which now allow emissions from CCS projects

45 For example the *IPCC Special Report on Carbon Dioxide Capture and Storage*, IPCC, 2005.

to be reflected in emissions reporting. This means that CCS projects will in principle be able to help countries to meet their targets for the first Kyoto commitment period, 2008-2012.

5.89 The development of these guidelines is a crucial step towards such projects being counted as Clean Development Mechanism (CDM) projects, which allow developed nations to achieve part of their emissions reduction obligations under the Kyoto Protocol through projects in developing countries. There are still outstanding issues preventing CCS projects from being recognised as CDM projects at present, but the Government is working hard with EU partners to reach agreement on this within the UNFCCC.

5.90 These new guidelines, and potentially the recognition of CCS as a valid source of emissions reduction under the CDM, should serve to incentivise investment in CCS projects in both the developed and developing world.

5.91 Further, the Government will continue to push for the recognition of CCS within the EU ETS. This issue has been considered by the European Commission through the European Climate Change Programme's Working Group on CCS, and a communication from the European Commission is expected in autumn 2007 on this and other issues relating to CCS.

Next steps

5.92 In the light of the significant cooperation that the UK is undertaking with Norway, the Carbon Abatement Technology Strategy's £10 million call for demonstration and the recent announcement of the Environmental Transformation Fund, the next step would be a commercial demonstration of CCS, if it proved to be cost-effective. Following HM Treasury's recent consultation on CCS, we will do more work on the potential costs of such demonstration projects. A further statement will be made at the Pre-Budget Report.

- **The Carbon Abatement Technology demonstration programme will formally launch its first call for proposals in September 2006, with a first call worth £10 million which will focus on the pre-commercial demonstration of key components and systems to support carbon abatement technologies.**
- **The Government will continue to work with international partners to amend international legal frameworks to provide the legal basis for CCS.**
- **The work of the CCS Regulatory Task Force will continue in consultation with industry and other stakeholders in order to clarify and develop proposals on appropriate regulations both to facilitate CCS and to ensure the environmental integrity of CCS activities.**
- **The Government will continue working with international partners to develop CCS's potential, including through the recently announced joint UK-Norway project on enabling CCS in the North Sea and the EU-China Near-Zero Emissions Coal initiative.**
- **The Government will continue to push for the recognition of CCS within the EU ETS.**
- **The Government believes that the next stage would be a commercial demonstration of CCS, if it proved to be cost-effective. More work on the costs of such demonstration projects will be undertaken, and a further statement will be made at the Pre-Budget Report.**

Electricity – Nuclear

Introduction

5.93 Nuclear power is a source of low carbon generation which contributes to the diversity of our energy supplies. Under likely scenarios for gas and carbon prices, new nuclear power stations would yield economic benefits in terms of carbon reduction and security of supply. Government believes that nuclear has a role to play in the future UK generating mix alongside other low carbon generating options. Evidence gathered during the Energy Review consultation supports this view.

5.94 Consultation evidence highlighted regulatory barriers which are faced by many energy projects, including nuclear. In response to this, the Government is setting out a proposed framework for the consideration of the relevant issues and the context in which planning inquiries should be held. This framework would be set out in a White Paper to be published around the turn of the year. To support preparation of this White Paper, Government is consulting on the proposals outlined in Annex A of this document. Under this framework, Government will assess planning applications on their merits, taking into account the policy set out in the previous paragraph.

5.95 Planning is a devolved matter and powers to grant consent for the construction of large power stations in Scotland have been executively devolved, therefore it will be for Scottish Ministers to take such decisions.

5.96 Any new nuclear power stations would be proposed, developed, constructed and operated by the private sector, who would also meet full decommissioning costs and their full share of long-term waste management costs. The Government does not take a view on the future relative costs of different generating technologies. It is for the private sector to make these judgements, within the market framework established by Government. The actual costs and economics of new nuclear will depend on, amongst other things, the contracts into which developers enter, and their cost of capital for financing the project.

5.97 However, for the purposes of this report, the Government has carried out a cost-benefit analysis of nuclear new build in order to inform its conclusions on the potential role of nuclear power and whether the Government should take facilitative measures to enable new build to come forward as a generating option[46]. This analysis is based on a number of gas prices, carbon prices and nuclear costs, rather than a single projection.

Nuclear is a potentially economic source of electricity generation

5.98 The economics of new nuclear build depend on expectations about future gas and carbon prices, as well as expected costs of building, operating, decommissioning and dealing with the waste of a new nuclear plant. Based on a range of plausible scenarios, the economics of nuclear now look more positive than at the time of the 2003 Energy White Paper. However, it will be for the private sector to make commercial decisions on investment in nuclear.

46 A summary of this cost-benefit analysis, together with other background information, is available on the DTI website www.dti.gov.uk/energy/review

5.99 The following table sets out a number of scenarios:[47]

Table 5.2: Nuclear generation welfare balance under alternative gas price, carbon price and nuclear cost scenarios, £m/GW

	Low gas price	Central gas, high nuclear	Central gas price	Central gas, low nuclear	High gas price
Carbon price = €0/tCO2	-2100	-1400	-400	900	1400
Carbon price = €15/tCO2	-1500	-900	200	1400	2000
Carbon price = €25/tCO2	-1100	-500	600	1800	2400
Carbon price = €36/tCO2	-700	0	1000	2300	2800

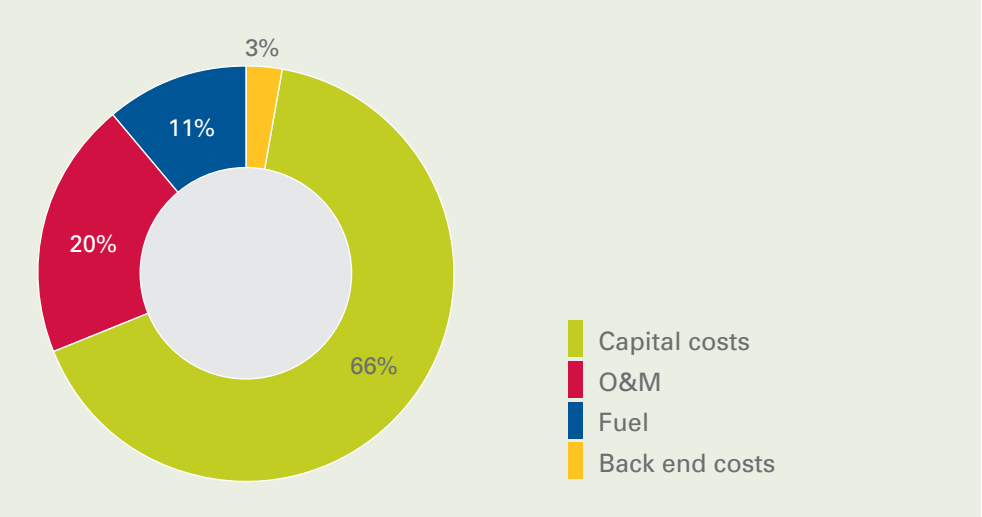
5.100 The central gas price scenario (37p/therm) reflects the current market situation. While the gas price has been around 20 pence/therm on average over the last decade, the average price in 2005 was 42 pence/therm. Going forward the central gas price is expected to remain high by historical standards, in line with expectations on the oil price. Sustained commitment to tackling climate change makes the positive carbon price scenarios more likely.

5.101 The cost of new nuclear power generation is assumed to be around £38/MWh, as a central case. However, we have also considered a high case of (£44/MWh) and a low case of (£30/MWh). For the central gas price scenario (37p/therm) and a carbon price of €36/tCO_2 the economics of nuclear remain robust for generating costs up to £43/MWh. This is well above the forecast cost of power generated from the Finnish nuclear project currently under construction, by a margin that far exceeds any historical cost overruns associated with nuclear projects, e.g. Sizewell B.

5.102 The cost profile of nuclear power is different from that of most other generating technologies. Chart 17 below shows findings for the proportion of the levelised cost of nuclear power (i.e. average cost per megawatt hour over the life of the power station) that may be attributed to each stage of a station's life. The majority of nuclear costs are capital, reflecting the complexity of the construction of the plant. By contrast, the fuel cost represents a small proportion of the overall cost.

47 The table shows monetarised environmental and security of supply benefits net of cost penalties in £m/GW, NPV over 40 years.

CHART 17. NUCLEAR COSTS BY STAGE



Source: DTI, 2006.

5.103 Increases in the price of fuel will have a relatively minor effect on the economics of nuclear, because fuel costs represent only approximately 11% of the levelised cost[48]. The doubling of uranium prices since 2000 has had only a minor impact on final fuel costs and overall generation costs[49]. By contrast, gas-fired generation is vulnerable to changes in the cost of fuel because this makes up 71% of its levelised cost[50].

Nuclear plays an important role in reducing carbon emissions

5.104 The full lifecycle release of CO_2 from nuclear power is similar to wind power, and much less than fossil fuel plant[51]. As an illustration of the many studies which have been conducted, the Organisation for Economic Development and Co-operation (OECD) Nuclear Energy Agency (NEA) has published a table (see table 5.3) giving the full lifecycle carbon emissions of a range of generating technologies.

48 DTI analysis 2006.
49 IAEA Red Book 2005.
50 DTI analysis 2006 – this assumes gas costs of 36.6p/therm, as per DTI assumptions set out in annex B.
51 Sustainable Development Commission, The Role of Nuclear Power in a Low Carbon Economy, Paper 2: Reducing CO_2 Emissions – Nuclear and the Alternatives, March 2006.

Table 5.3: Total Lifetime Releases From Selected Technologies		
Technology (2005-2010)	GC/kWh*	1.Equivalent to GCOÇ/kWh**
Lignite	228	836
Coal	206	755
Natural Gas	105	385
Biomass	8-17	29-62
Wind	3-10	11-37
Nuclear	3-6	11-22

*Grams of Carbon per kilowatt hour of electricity produced.
** Grams of Carbon Dioxide per kilowatt hour of electricity produced.
Source: OECD Nuclear Energy Agency.

5.105 Some respondents to the Energy Review consultation questioned nuclear's credentials as a net producer of low carbon energy, particularly in relation to the availability of high quality uranium ore. Lower grade ores will require more energy to make fuel for nuclear power stations, which could increase the lifecycle carbon emissions from nuclear power. However, it is not expected that high-grade resources will be depleted in the foreseeable future[52]. This view is endorsed by the International Atomic Energy Agency (IAEA) and NEA; none of the planned new mining projects are of significantly lower grade ores than that currently mined[53]. As such, we can have confidence that the estimates of the lifecycle emissions from nuclear will remain comparable with wind power, a view highlighted by the Sustainable Development Commission[54].

Nuclear contributes to increased diversity of energy supplies

5.106 Nuclear currently provides around 20% of the country's electricity needs and a significant proportion of its baseload capacity. However, most of our existing nuclear power stations are scheduled to close over the coming two decades. In the absence of new nuclear build or life extensions to existing nuclear plant, the nuclear share of generation will decline sharply by the 2020s. Much of our coal generating capacity is also likely to face closure over this period. We expect a substantial increase in renewable capacity by then. However, central projections indicate that based on the existing market framework, many of the closing power stations would be replaced with gas-fired power stations. This would increase our dependence on imported gas. By 2020, electricity generated by gas would probably be around 55%.

5.107 There is a possibility of extensions to the scheduled lives of some existing nuclear plant. However, this is uncertain, and will remain so for some years. Any life extensions would help mitigate the decline in low carbon generation in the period towards the end of the next decade. However, it is less clear and certain that life extensions would have a significant impact on the amount of nuclear capacity operating in the 2020s.

52 Sustainable Development Commission The Role of Nuclear in a Low Carbon Economy – "Paper 8 Uranium Resource Availability".
53 Information from IAEA member states submitted to IAEA/NEA for "*Uranium 2005: Resources, Production and Demand*", aka "Red Book".
54 Sustainable Development Commission The Role of Nuclear in a Low Carbon Economy – "Paper 2 Reducing CO2 Emissions – Nuclear and the Alternatives".

5.108 Investment in new nuclear capacity would help to sustain a diverse electricity generation mix, by reducing the level of total UK gas consumption and gas imports. For every gigawatt of nuclear capacity displacing gas-fired generation, gas demand is expected to be approximately 1.3bcm lower than otherwise (representing roughly 1% of projected gas demand in 2020). This could make an important contribution to the diversity of our energy supplies, particularly in light of the decline in indigenous gas supplies from the North Sea.

Availability of fuel

5.109 Realising the potential benefits of new nuclear build would naturally be dependent on the availability of fuel. The range of assessments of future prospects for uranium supplies reflects the difficulty of making exact predictions, in exactly the same way as predictions of future oil and gas reserves are complex.

5.110 Predictions on how long uranium deposits will last in any given country are dependent on a number of variables:

- the number of new mines and the rate at which they come on stream;
- the price of uranium ore. The price affects the mining market and may make mining of certain deposits more viable;
- new nuclear reactor technology may use less uranium thereby extending the lifetime of available uranium deposits;
- more nuclear reactors may be built globally, thereby increasing the demand on available uranium deposits; and
- increased use of reprocessing to recycle used fuel and create MOX (Mixed Oxide) fuel (a mix of uranium and plutonium) will require less uranium.

5.111 Every two years, the IAEA and NEA undertake a comprehensive assessment of the availability of uranium, taking into account expected production and demand levels. Their most recent report[55] estimates the identified amount of conventional uranium resources that can be mined for less than USD 130/kg (just above the current spot price) to be about 4.7 million tonnes. Based on the 2004 nuclear electricity generation rate this amount is sufficient for 85 years. Deposits of uranium ore are distributed across a range of countries, including those on whom we are not currently dependent for fossil fuels. Using IAEA figures it is possible to make a rough, high-level estimate that reserves in Australia alone will last another 150 years, with reserves in Canada lasting 45 years, based on current estimated resource and production levels[56].

5.112 The demand for uranium has increased in recent years, resulting in higher prices for uranium ore. However, the IAEA expect future increases to be modest, even with further increasing global demand. Prices are expected to remain substantially below historically high levels of the 1970s. At the same time the increases we have seen are expected to encourage further exploration of uranium resources, as can be seen from the new mines expected to open across the world and from the increasing exploration.

55 IAEA/NEA Red Book 2005.
56 IAEA/NEA Red Book 2003, updated 1 June 2006.

Nuclear Waste

5.113 The 2003 Energy White Paper noted that there are "important issues for nuclear waste to be resolved". Work is underway to tackle the legacy of nuclear waste. The Nuclear Decommissioning Authority (NDA) is setting a UK-wide strategy for more effective decommissioning and clean up of its sites. The Committee on Radioactive Waste Management (CoRWM) was established in the second half of 2003 to make recommendations on the best options for the long-term management of the UK's higher activity radioactive waste. It has evaluated the options in an open and inclusive manner and Government believes the approach they have taken will provide a sound basis for building future consensus.

5.114 CoRWM produced interim recommendations in April. In these, CoRWM concluded that deep geological disposal in a repository is the best available approach for the long-term management of waste, and that a programme of interim storage (already planned by the NDA as part of its strategy) is required. While CoRWM has no position on the desirability or otherwise of nuclear new build, CoRWM has however said that "in principle" new build wastes could be incorporated within in their options, although this would raise practical issues about the size, number and location of facilities, which would need to be properly assessed[57]. CoRWM's final report will be published at the end of July. The Government will respond in a formal statement to parliament as will the Devolved Administrations, setting out how work to manage long-term waste will be taken forward.

5.115 The UK has a historic legacy of nuclear waste that it is estimated will total 475,000m^3 (high and intermediate level). Similar to France, the UK's legacy nuclear wastes include a complex mix of waste forms from both the civil and military programmes which increases the technical challenges in conditioning them for ultimate disposal. Through the NDA, and the nature of the ownership of the current civil nuclear industry, the public sector is ultimately responsible for delivering and paying for a long term waste management solution. The private sector would pay its full share of the costs of long term waste management arising from any new nuclear build.

5.116 Modern nuclear plants produce significantly less waste than early generations of nuclear reactors by volume. CoRWM's inventory study suggests that if the current level of nuclear capacity were replaced with new build, existing waste stocks would increase by about 10% by volume.

Regulatory Protection

5.117 The UK already has in place a mature regulatory framework to ensure the safety, security and environmental risks of nuclear are managed effectively. Before any developer is allowed to begin construction of a nuclear power station, they must have a site licence from the Nuclear Installations Inspectorate (NII), part of the Health and Safety Executive (HSE). This licence certifies that the design can be operated safely with risks "as low as reasonably practicable".

57 CoRWM draft recommendations www.corwm.org.uk

Regulatory Protection – Safety

5.118 Nuclear power stations in the UK must be designed and operated to stringent standards which demand that all reasonably practicable steps are taken to avoid accidents, as well as requiring multiple barriers to mitigate the consequences of any that might occur. Safety standards have advanced over the years and the IAEA has developed a suite of international safety standards that reflect worldwide good practice. The recent revision of HSE's Safety Assessment Principles has been benchmarked against those international standards.

5.119 Nuclear power stations are designed so that there are a number of different safety systems, with multiple back-ups, resulting in a robust system for responding to abnormal operation and fault conditions. The current safety assessment principles state that safety equipment should be actuated automatically, and that no human action should be necessary for at least 30 minutes.

5.120 The risks of a nuclear accident with significant offsite impacts are very small. Globally, in the history of civil nuclear power there have been ten incidents that have resulted in offsite impacts, as classified by the IAEA/OECD International Nuclear Event Scale[58]. While some of these incidents were extremely serious, the majority had only minor consequences. The Sustainable Development Commission has described the UK's civil nuclear power stations have having an "excellent safety record". In the UK, there have been no major incidents relating to a civil nuclear power station and there have been no events recorded either with off-site consequences or where all safety barriers had been exhausted. The most serious incident, the 1957 Windscale accident, where there was an off-site release but no loss of life or long-term environmental damage[59], occurred at a reactor of a very early design, designed solely for military purposes[60].

5.121 Modern reactor designs are expected to reduce the very small accident risks still further[61]. Modern designs have multiple layers of protection to guard against faults and wherever possible employ safety systems which operate passively and require no operator intervention. Passive safety systems further reduce the human error factor, which in the past has been a factor in some of the more serious nuclear incidents.

Regulatory Protection – Radiation

5.122 Radiological protection of employees and the general public in the UK is covered by a structured legal framework. Any discharge of radioactivity to the environment from a nuclear site is only permitted under an authorisation from the relevant environmental regulator[62]. Doses to the public as a result of authorised discharges are kept as low as reasonably achievable by the regulators' requirement that operators use best practicable means to minimise the activity of waste discharged.

58 Sustainable Development Commission The Role of Nuclear in a Low Carbon Economy – "Paper 6 Safety and Security", March 2006.
59 cited in Sustainable Development Commission Report "Paper 6 Safety and Security", March 2006.
60 In response, the Government of the day set up an independent nuclear regulator, HM Nuclear Installations Inspectorate, which is now part of HSE.
61 Sustainable Development Commission Report "Paper 6: Safety and Security", March 2006.
62 The Environment Agency in England and Wales and the Scottish Environment Protection Agency in Scotland.

5.123 Permitted dose levels to the public, as a result of nuclear industry operations, are only a small fraction of natural background radiation, which makes up 80% of the average annual dose. The average dose to a member of the public, due to radioactive discharges, is 0.015% of the annual average dose from all sources[63]. The largest source of manmade radiation relates to medical exposures, accounting for 14% of the average annual dose[64].

Regulatory Protection – Security and Non-Proliferation

5.124 Although the international security situation is expected to remain at current levels in the medium to long term, the Office for Civil Nuclear Security (the UK security regulator) considers that new nuclear build would be unlikely to increase risks to the UK. Any new plant would be built taking the current threat environment into account, with robustness and security built-in, rather than retro-fitted as with the existing plant.

5.125 An international mechanism for keeping track of nuclear material, referred to as Safeguards, is operated by the International Atomic Energy Agency (IAEA) and the European Commission to detect and prevent diversion of this material from peaceful use. The UK, as a nuclear weapons state, has a voluntary agreement with the IAEA and is a signatory of the EURATOM Treaty, both of which cover all our civil nuclear installations, as part of this regime. Any new nuclear reactors would be covered by these agreements. The proliferation risks from an increase in the number of modern reactors in the UK are small; all of the plants that industry have highlighted as potential candidate designs for new build in the UK can be considered as low-proliferation risk. To further international non-proliferation objectives, the UK is working with US, France, Russia, Germany and other states, as well as the IAEA, to establish international assurance of supply for nuclear fuel which is aimed at avoiding widespread investment in sensitive enrichment and reprocessing plants, which can have a greater proliferation risk.

Where might new nuclear plant be built?

5.126 Any new nuclear stations would be proposed, constructed and operated by the private sector. Industry has indicated that the most viable sites for new build are likely to be adjacent to existing nuclear power plants. It will be up the potential participants of new build to discuss with the owners appropriate access to suitable sites. We will undertake a further assessment which will help developers in identifying the most suitable sites. Government will monitor whether an appropriate market in suitable sites is developing.

Networks

5.127 The Government has examined whether the transmission network could be a potential barrier to new nuclear generation. The costs of accommodating new nuclear build at existing sites vary considerably. This is because the existing capacity at some sites is lower than others. Some sites will therefore require extensive upgrading or new overhead lines, many requiring new planning approval. Such costs are likely to be a factor in the private sector's site selection process. There could also be costs incurred from needing to upgrade the system further away from the site to accommodate increased flows of energy.

63 Sustainable Development Commission Report "Paper 6: Safety and Security", March 2006.
64 Sustainable Development Commission Report "Paper 6: Safety and Security", March 2006.

Supply Chain and Skills

5.128 One issue which was raised during the Energy Review consultation was the potential for shortages in the supply chain for all types of new power station. This is due to increased global demand for limited resources and a shrinking skills/company base. Addressing some of the regulatory barriers associated with civil nuclear power (as set out below) should enable industry to undertake long-term planning, allowing pre-positioning of resources, orders and manufacturing slots. It would also enable industry to secure the engineering design resource from the technology provider.

5.129 The Nuclear Industry Association believes that nuclear skills are available for new nuclear build and that potential skills pinch points can be managed through long-term planning and training programmes. The Cogent Sector Skills Council was licensed in March 2004 to take a strategic view of the nuclear sector; a Cogent Labour Market Study completed in September 2005 was generally positive, with few shortages in specialist areas and reported that the industry is making a high commitment to training. The Engineering Construction Industry Training Board is working with its client companies to resource a significant increase in UK investment over the coming decade. The Energy and Utility Skills Sector Skills Council has taken steps to ensure that the skills to support the expansion of the transmission system will be in place.

5.130 UK Research and Development capability will be critical to the nuclear clean-up programme going forward and may also become important to support other strategic initiatives such as new nuclear build in the future. While the market should provide much of the nuclear R&D that will be needed, Government will want to ensure in any transitional period that current key R&D capabilities are preserved and developed, potentially as part of a National Nuclear Laboratory. We will be carrying out some detailed work over the coming months to establish the way forward on this.

Proposals

5.131 Within the UK's market-based framework, it is for companies to make investments in new power stations, including investments in any new nuclear stations. However, interested parties have made clear as part of the Energy Review consultation that if new nuclear is to play a role in the future of UK electricity generation, the Government needs to address a number of regulatory barriers. Some of these barriers are common to all large energy projects, while others are specific to nuclear. The current planning systems creates delays and uncertainties for all energy infrastructure projects (see chapter 7 for more detail). The inquiry for Sizewell B (the most recent nuclear plant to be built in the UK) took 73 months, with the direct inquiry costs reaching £30m. Our proposals to tackle the regulatory barriers facing nuclear are set out below.

Pre-Licensing

5.132 Government welcomed the recent independent expert report published in June by the HSE/NII that, among other things, set out the potential role of pre-licensing assessments of candidate reactor designs. Government also welcomes a similar report by the Environment Agency on the potential to provide their own pre-authorisation statements in relation to radioactive discharges. Based on these expert reports, Government has asked HSE/NII to

take forward proposals to introduce a pre-licensing, design authorisation procedure, and the Environment Agency to introduce a similar system of pre-authorisation. We expect the regulators to work closely together to introduce an integrated regulatory framework.

5.133 The new framework would allow potential developers to apply for pre-licensing approval for a generic reactor design before committing significant sums of capital to planning and construction. Providing the subsequent development and construction followed this "pre-licensed" standard design, potential developers should be confident that their site licence application would be approved by HSE/NII without significant (and potentially costly) design modifications to address unresolved issues.

5.134 The Office for Civil Nuclear Security (OCNS) and the Environment Agency expect to contribute to the HSE/NII's pre-licensing process to avoid the need to add measures to the design after the safety case has been made. A staged approach to licensing was one of the recommendations of a recent IAEA review as a sensible way to manage any new build. HSE will develop guidance for this new process to be in place by the start of 2007. The Government has asked HSE/NII to develop more detailed guidance for this process to be in place by the start of 2007.

Planning – Setting the Policy Framework for New Nuclear Build

5.135 The recommendations on streamlining the planning process for all large electricity infrastructure projects are outlined in detail in chapter 7. Any nuclear projects in England and Wales would also benefit from these changes. As is discussed in chapter 7, Scotland has its own planning system and is taking forward work to make it more efficient. Scottish Ministers will also take any planning permission decisions for any new nuclear power stations in Scotland.

5.136 In addition, Government is setting out a proposed framework for the consideration of the issues relevant to new nuclear build and the context in which public inquiries, as part of the planning process, should be held. This framework would be set out in a White Paper to be published around the turn of the year. To support preparation of this White Paper, Government is consulting on the proposals outlined in annex A of this publication.

5.137 We are seeking views on a policy framework in which national strategic and regulatory issues are most appropriately discussed through processes other than the public inquiry. The inquiry should focus on the relationship between the proposal, the local plans and local environmental impacts. The inquiry should weigh up these issues against the national strategic or regulatory material considerations, which will have already been established. The inquiry should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.

Waste and Decommissioning

5.138 Satisfactory arrangements will need to be established for dealing with the costs of decommissioning and waste from nuclear new build. Government will need to be satisfied an appropriate structure is in place to ensure that participants in nuclear new build deal with these costs. It is important that arrangements are sufficiently robust, particularly given that in order to comply with its international obligations for nuclear safety Government must bear the ultimate responsibility for the management (or disposal) of radioactive waste and spent fuel in the event that no other party is able to discharge those obligations.

5.139 Government will engage with industry and other experts to develop arrangements for managing these costs based on the principles set out below. The first step will be for Government (with the support of the NDA) and industry to have a common understanding of the likely costs of decommissioning and waste management. Industry participants will need to meet the financial requirements established by the Government's decommissioning and waste frameworks even in challenging downside scenarios.

5.140 In the case of waste disposal costs it is recognised there will need to be a mechanism that shares the burden between the existing legacy wastes and the cost arising from nuclear new build.

5.141 Government intends to appoint an individual with senior management or financial experience of major capital investment projects to lead the development of arrangements for the costs associated with new build decommissioning and waste management. This individual, who will be supported by officials from the DTI, will lead discussions with industry on these topics and make proposals, based on the principles set out below. Further details on the work programme and timetable will be published by the time of the White Paper.

5.142 **Principles: The Risk Management Framework – Decommissioning**

- There should be an upfront assessment of decommissioning costs.
- Full responsibility for decommissioning costs to be retained by the private sector operator(s).
- Protection will be given to the public sector regarding credit risk and reduced reactor life.
- The framework should be robust and transparent through time.
- These principles will form the basis of arrangements which will apply consistently to all new build operators and reactor types.

5.143 **Principles: The Risk Management Framework – Waste**

- Delivering and paying for a long term waste management solution for legacy waste is a responsibility that falls to the public sector. Any long-term waste management solution developed by Government will factor in waste from new build.
- There will be an assessment of how new build affects the cost of delivering the national waste management solution.

- The private sector will pay a charge covering the full and equitable costs of managing the waste generated over the expected life of each new power station.
- The level of this charge will be informed by work on the Government's long term waste management solution.
- The commercial nature of the arrangements in relation to waste disposal will incentivise participants to operate power stations in a way that seeks the optimal balance between performance and waste generation.
- Protection will be given to the public sector regarding changes in reactor life and other factors.
- Provision of interim storage over the life of the plant will be the responsibility of the operator.
- The framework should be robust and transparent through time.
- These principles will form the basis of arrangements which will apply consistently to all new nuclear build operators and reactor types.

Nuclear Proposals

- **The Government believes that nuclear has a role to play in the future UK generating mix alongside other low carbon generation options.**
- **Any new nuclear power station would be proposed, developed, constructed and operated by the private sector who would also meet decommissioning and their full share of long-term waste management costs.**
- **We will undertake further assessment which will help developers in identifying the most suitable sites. It will be up to the potential participants of new build to discuss with the owners appropriate access to suitable sites. Government will monitor whether an appropriate market in suitable sites is developing.**
- **Government has asked HSE to take forward proposals to introduce a pre-licensing, design authorisation procedure, and the Environment Agency to introduce a similar system of pre-authorisation.**
- **Government is setting out a proposed framework for the consideration of the issues relevant to new nuclear build and the context in which planning inquiries should be held. This framework would be set out in a White Paper to be published around the turn of the year. To support preparation of this White Paper, Government is consulting on the proposals outlined in annex A of this publication.**
- **We are seeking views on a policy framework in which national strategic and regulatory issues are most appropriately discussed through processes other than the public inquiry. The inquiry should focus on the relationship between the proposal, the local plans and local environmental impacts. The inquiry should weigh up these issues against the national strategic or regulatory material considerations, which will have already been established. The inquiry should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.**

- **As is proposed for the more contentious onshore wind projects, Government will appoint a high-powered inspector whose role will be to ensure that planning inquiries are run to clearly defined timescales, and maximum use is made of the powers and efficiencies set out in the major infrastructure projects rules.**
- **Government will engage with industry and other experts to develop arrangements for managing the costs of decommissioning and long term waste management based on the principles set out in this text.**
- **Government intends to appoint an individual with senior management or financial experience of major capital investment projects to lead the development of arrangements for the costs associated with new build decommissioning and waste management. This individual, who will be supported by officials from the DTI, will lead discussions with industry on these topics and make proposals, based on the principles set out below. Further details on the work programme and timetable will be published by the time of the White Paper.**

CHAPTER 6

Transport

Transport in the wider context

6.1 Transport dominates the UK's use of oil with 74% of supply used to power the cars, planes, buses, trains and lorries that we depend upon. This produces 42 million tonnes of carbon (MtC) per annum or around a quarter of all current UK carbon emissions. Good transport services are essential for a successful economy and society. They provide access to jobs, services and schools, deliver goods to shops, and allow us to enjoy our free time.

6.2 Although emissions from this sector have increased since 1990, growth in emissions is slowing down, and is not expected to grow as strongly in the future. Emissions from transport are projected to reach a peak around 2015 and thereafter fall. This is on the basis of projections that growth in demand for transport moderates, fuel efficiency in transport continues to improve and lower-carbon fuels, especially biofuels, increase their market share.

6.3 Current government policies tackle transport emissions using a full range of policy levers. Since 1997, the Government has introduced a range of economic instruments to incentivise take-up of lower-carbon transport fuels and vehicles, including the Renewable Transport Fuel Obligation, reforms to Company Car Tax and Vehicle Excise Duty. These are supported by EU voluntary agreements on new car fuel efficiency, measures encouraging people to make more sustainable travel choices and record investment into public transport to give people a viable alternative to travelling by car.

6.4 Analysis for the recent Climate Change Programme Review showed that existing Government policies in transport would save similar amounts of carbon in 2010 (proportional to sector emissions) as in other sectors and that had we not acted emissions from transport would have been 15% higher in 2010.

6.5 Nonetheless, the Government recognises the scale of the environmental challenge for transport and the urgent need for robust action to tackle the problem of rising carbon emissions. We are committed to taking action in the near term whilst also looking to the future and our long-term goals. That is why we have already put in place a range of policies which taken together will have a significant impact on transport emissions. We are working in four ways to tackle the emissions from transport in both the near and the long term by:

- reducing the carbon content of transport fuel;
- reducing the carbon emissions of vehicles;
- encouraging moves toward more environmentally-friendly transport; and
- working in Europe to include aviation in emissions trading, and to consider including surface transport.

6.6 In the near-term, measures to reduce emissions from transport are often difficult and expensive to implement. Securing a change in people's transport behaviour and their choice of transport is also not straightforward. In the longer term we expect the emergence of new technologies including hybrids,

advanced biofuels and hydrogen to play a major part in reducing transport emissions post 2020. New vehicle technologies take a long time to feed through to market and become more widespread.

6.7 This report summarises a range of policies which are aimed at delivering carbon reductions in the near-term. It also focusses on putting in place the incentives and framework necessary to pull through the longer term technological developments to reach our ambitious 2050 carbon target.

6.8 The policies presented below reflect the fact that without policy intervention the cars that we currently buy and the way we currently travel will not get us to where we need to be in emissions terms, due to market failures. These include failure of information reaching consumers to allow them to make informed decisions and market failures that inhibit innovation (e.g. high risk premiums, uncertain carbon markets and technology lock-in).

6.9 These policies consider cost-effectiveness as well as the importance of supporting the development of a broad range of different technologies. They also recognise the importance of undertaking the challenging but vital work of securing the agreement of other countries to spread the positive impact of such policies beyond what could be achieved in the UK alone.

Reducing the carbon content of transport fuel

The level of the Renewable Transport Fuel Obligation will be increased provided important conditions are met.

6.10 In November 2005, the Government announced it would introduce a Renewable Transport Fuel Obligation (RTFO). This requires transport fuel suppliers to ensure a proportion of their sales are from renewable sources. The RTFO will be introduced in 2008/9 with the obligation level rising to 5% by 2010/11. We estimate that this policy alone will save one million tonnes of carbon in 2010, the equivalent to taking one million cars from our nation's roads.

6.11 The Government now intends the level of the Obligation to rise above 5% after 2010/2011 provided three critical factors are met:

- development of robust sustainability and carbon standards for biofuels to ensure that they are delivering high levels of carbon savings without leading to biodiversity loss or endangering sensitive habitats;
- development of new fuel quality standards at EU level to ensure existing and new vehicles can run on biofuel blends higher than 5%; and
- costs to consumers being acceptable.

6.12 If these criteria are met, and for example we were able to raise the level of the obligation to 10% by 2015, we would save up to a further million tonnes of carbon a year, equivalent to removing yet another one million cars from our roads. The Government will be consulting stakeholders on such future enhancements to the RTFO as part of its consultation on the RTFO Regulations in early 2007.

Reducing the carbon emissions of vehicles

6.13 In addition to improving the carbon content of our fuels we are also looking to improve the fuel efficiency of vehicle engines. Our work with manufacturers and our European partners has secured real progress in recent years. The Voluntary Agreements on new car fuel efficiency between the European Commission and the automotive industry have seen new car carbon emissions fall by 12% across the EU since 1995.

6.14 The current Voluntary Agreements on new car fuel efficiency between the European Commission and the automotive industry are due to expire in 2008/2009. These aim to reduce new car average CO_2 emissions to 140g/km; an improvement of 25% compared to 1995.

6.15 The Government believes that while improvements have been made, the full potential of an EU-wide scheme has not yet been fully realised. The UK will therefore continue to work with the European Commission and relevant stakeholders in developing successor arrangements to the current Voluntary Agreements on new car fuel efficiency.

6.16 While any decision on successor arrangements will be subject to consultation with the vehicles industry and other stakeholders, the UK will maintain our stance that all options, including mandatory targets with trading, must be considered.

6.17 Despite the work outlined above to increase the efficiency of vehicles and reduce the carbon content of fuel, it is clear that over the longer-term, the development of low carbon technologies is vital to secure large cost-effective reductions in carbon emissions from the transport sector. Encouraging such developments requires further technological developments. If the right technologies are not brought from laboratory research and development all the way to commercialisation, these options will be closed off, and we will be severely restricted in our ability to reduce carbon emissions.

6.18 Technologies such as plug-in hybrids, advanced biofuels and hydrogen are now being developed internationally. Hydrogen is an "energy carrier" which can be used in a fuel cell (where it produces zero emissions at the point of use) and in normal combustion (e.g. an internal combustion engine). Studies published with this Review show that for the UK the use of hydrogen offers significant opportunities for cost-competitive CO_2 reductions in transport by 2030. None is readily available today but they are sufficiently promising to be worth pursuing as energy options for the UK.

6.19 In June 2005, the Government published "A Strategic Framework For Hydrogen Energy Activity in the UK", which included a funding package of £15 million over four years for a UK wide hydrogen and fuel cell demonstration programme. Currently the Government supports industrial collaborative research and development for fuel cell and hydrogen technologies through the programme.

6.20 The Government has also provided funding of over £450,000 for the trial of hydrogen-powered fuel cell buses in London as part of the EU CUTE (Clean Urban Transport in Europe) project. £6.5 million of funding has been

committed for the fuel cell and low carbon vehicle technology Centre of Excellence (CENEX) based in Loughborough. The Department for Transport announced in January, as part of their Horizons innovative research programme, a competition for projects to investigate the options for the further steps required to move to the adoption of a hydrogen transport infrastructure. This will support 2-4 projects examining the practicality and timing of the introduction of the required infrastructure to support hydrogen-fuelled vehicles.

6.21 The Government announced in 2003 a £10 million programme to encourage the development and demonstration of Low Carbon Passenger Cars. This programme was subsequently administered by the Energy Savings Trust (EST) and the first of three funded projects on hybrid technology was completed successfully in 2006.

6.22 The Government commissioned an assessment of the future potential of low carbon transport technologies, discussing the issues and difficulties surrounding each[65]. This work looked at all transport technologies, vehicles and fuels that have the capability to bring about large reductions in carbon emissions, principally hydrogen, advanced biofuels and hybrid technologies. It summarised the carbon abatement potential of each, the present blocks to implementation, as well as current and future costs.

6.23 We think there is scope to do more to ensure there is a consistent, Government wide framework for incentivising technology in transport. We therefore propose to develop a Low Carbon Transport Innovation Strategy to spur vital innovation in low carbon transport technologies. This will complement the recently announced National Institute of Energy Technologies. For all technologies that show promise the Innovation Strategy will:

- efficiently allocate money to laboratory research and development;
- facilitate development into working products;
- find funding for practical demonstrations in the real world; and
- allow the most cost-effective technologies to come to market.

6.24 The Innovation Strategy will be evidence-based. It will aim to leverage efficiently private sector funding, make minimal demands of public funds, and progress the use of international partnerships to improve resource sharing and knowledge transfer.

6.25 The Strategy will review current government policies that affect transport innovation and make recommendations for changes and for new policies. The Strategy will be taken forward in conjunction with the Powering Future Vehicles Strategy Review this year. By analysing the entire innovation system, a more co-ordinated approach to incentivising technology will be developed. In taking forward the Low Carbon Innovation Strategy we aim to assist not simply innovation but also the application of technologies that will significantly reduce carbon emissions in the long term.

65 E4Tech, "UK carbon reduction potential from technologies in the transport sector", May 2006.

Encouraging moves toward more environmentally-friendly transport

6.26 The Government's record investment in transport infrastructure, to give more people real alternatives to travelling by car, reflects our commitment to reducing the carbon impact of transport by encouraging more environmentally friendly forms of transport. Britain now has the fastest growing railway in Europe – with more than a billion passenger journeys undertaken last year. People are now travelling further by rail than in any year since 1946. Since 1996-97, rail passenger kilometres have grown by 30%, and rail freight is up by 36%.

6.27 The foundation on which this growth has been achieved is unprecedented levels of government investment in the rail network to address decades of under-investment. For example, between 2004/5 and 2008/9 the Government will be spending over £23 billion on Britain's railways to make up for years of under-investment. Next year we will set out firm plans for the coming five years to meet the demands of a growing railway.

6.28 Buses too provide essential alternatives to the private car, especially where congestion – and the associated problems of air quality – are a growing problem. The Government has worked to halt the long-term decline in bus use. Local and central Government provides over £2 billion annually to provide bus services that offer a genuine alternative to the car. Rural Bus Subsidy Grant now supports over 2,200 rural bus services with over 29 million passenger journeys made on these services annually. Total journeys taken in England by bus have increased for each of the last 6 consecutive years; in the last 5 years bus use in England has grown by around 8%.

6.29 But in too many places outside London, bus use is still declining. The Department for Transport is therefore currently examining the existing arrangements for bus provision and will be working through in the coming months proposals for improving the public transport offer provided by buses outside London.

6.30 Together with these investments and innovations in public transport, the Government promotes a package of policies entitled Smarter Choices, aimed at helping people choose sustainable travel options. Smarter Choices projects include the Travelling to School initiative which aims to have active travel plans in every school in England by the end of the decade. In recent weeks the Government has also doubled Cycling England's budget to £30 million over the next three years.

6.31 The Government has embarked upon a programme to enhance consumer information on transport emissions and climate change. A key part of our strategy is to ensure individuals and manufacturers have the right information and incentives to encourage them to make the most environmentally friendly choices on transport.

6.32 The decisions of individuals on vehicle purchase and mode of transport have a significant impact on carbon emissions. We need to ensure that consumers have the right information when buying vehicles to allow them to make choices informed by the impact on climate change. With this in mind, most UK car showrooms now display colour-coded fuel efficiency labels,

developed and delivered in close cooperation with the vehicle industry and the Low Carbon Vehicle Partnership (LowCVP), which are directly linked to the Vehicle Excise Duty (VED) bands and which will be familiar to consumers used to similar labels for their household white goods. We also need to make information more readily available to travellers generally on the carbon impact of their travel choices.

6.33 Many citizens are now seeking a clearer understanding of the carbon consequences of the travel choices they make. The Government will therefore act to raise awareness of transport and climate change issues and the options available to individuals. This will be achieved by:

- improving the quality of information available to purchasers of new vehicles; and
- improving access to information for travellers on the carbon impacts of different modes of travel.

6.34 This approach will include developing initiatives to promote consumer information on buying greener vehicles, on eco-safe driving, and to assist businesses by promoting the benefits of workplace travel planning.

6.35 The Government has delivered a series of fiscal measures to incentivise consumers to use more fuel efficient vehicles. The principle that fiscal measures can play a part in achieving our environmental goals has been established. Company Car Tax was reformed in 2002 to make it carbon-based. Vehicle Excise Duty, which was flat-rate in 1997, was graduated in 2001 by carbon emissions. In Budget 2006 the banding system was reformed, reducing the duty for the lowest emission cars to zero and increasing the duty for the highest emissions cars to £215. Combined with savings expected from the Voluntary Agreement on new vehicle fuel efficiency these measures are expected to deliver reductions of 2.3m tones of carbon in 2010. Based on the principles of policy already established, we will continue to examine how fiscal and other policy instruments can achieve these aims.

The UK is leading in Europe to expand the EU Emissions Trading Scheme to include aviation, and to consider the case for future inclusion of surface transport.

6.36 Emissions trading uses market forces to deliver emissions reductions in the most cost effective manner. It guarantees a specific environmental outcome in a way that other instruments do not. It allows coverage of environmental costs through a mixture of emission reductions within a particular sector and purchase of reductions in circumstances where these can be produced more cheaply by other sectors. The cost of reducing emissions in transport is currently relatively high. Therefore transport would be expected to buy credits from other sectors that can reduce emissions more cheaply in the short term. This would be expected to change over time as the price incentive helps make new technology more widespread in transport, causing abatement costs to fall relative to other sectors.

6.37 Larger trading schemes have greater scope for finding the most efficient carbon reductions. Including surface transport and aviation in the EU Emissions Trading Scheme could therefore lower the overall costs to the economy of combating climate change.

6.38 Last year under the Presidency of the United Kingdom, the European Union made real progress towards including aviation in the EU Emissions Trading Scheme (EU-ETS) from 2008 or as soon as possible thereafter. The European Commission now aims to produce a legislative proposal and impact assessment on the inclusion of aviation in the EU ETS by the end of 2006. The Government continues to explore options for the use of other economic instruments and reserves the right to act alone or bilaterally if progress towards agreements at international level proves too slow.

6.39 The European Commission is currently carrying out a review of the EU ETS. The Government will ensure that inclusion of emissions from surface transport is given serious consideration in this review. The Secretaries of State for DfT, DTI, and Defra have already jointly written to the Commission to ask them to take this step.

The combination of these policies, if fully delivered, would substantially reduce carbon emissions

6.40 In the longer term, technology development can produce substantial carbon reductions from transport, but this requires action now to provide the right incentive framework. Government recognises the urgency of tackling the problem of rising carbon emissions in the transport sector. In the medium term, the policy package could deliver significant carbon savings – some of which are quantified here. A successor to the existing Voluntary Agreements and moving beyond a 5% RTFO could reduce carbon emissions from transport by around 2 – 3 MtC in 2020. Adding surface transport into the EU ETS with demanding caps (which the Government believes merits serious consideration), might save 4 – 7 MtC 2020[66]. More significant reductions would be likely to come after 2020 as technological development enables goods and people to be transported with lower carbon emissions.

6.41 There would be positive effects on security of supply. A successor to the Voluntary Agreements could save approximately 3 billion litres of fuel (petrol and diesel) per year by 2020. Every 1% increase in the RTFO could save around 0.5 billion litres a year, replacing these with fuels from renewable sources.

6.42 The achievement of the savings set out above would require all these proposals to be implemented fully. This requires action by individuals, business, by national governments and international organisations such as the EU. The scale of the challenge is considerable, but so too are the opportunities. The Government recognises its responsibilities to secure a modern, efficient system that gets people to work, allows businesses to

66 These numbers are highly dependent on several assumptions and should be thought of as indicative of the kind of reductions that could be expected.

operate effectively, enables goods to be transported efficiently, and allows people to make the most of their leisure time. But we are clear that we need to achieve these transport goals whilst meeting our environmental obligations.

Transport Commitments

- **Government intends the level of the Renewable Transport Fuel Obligation to rise above 5% after 2010/11 provided robust carbon saving and sustainability assurance schemes can be developed, technical vehicle and fuel standards are adequate and costs to consumers are acceptable.**
- **Government will engage with key organisations, the European Commission and other EU member states to ensure that the potential for future inclusion of emissions from surface transport in the EU Emissions Trading Scheme (ETS) is given serious consideration.**
- **Government will continue to work with the European Commission and relevant stakeholders in developing successor arrangements to the current Voluntary Agreements on new car fuel efficiency when those Agreements expire in 2008/09. This must include consideration of all options, including mandatory targets with trading.**
- **Government reaffirms its support for the inclusion of aviation in the EU ETS and continues to take a leading role in its promotion. It continues to explore options for the use of other economic instruments and reserves the right to act alone or bilaterally if progress towards agreements at international level proves too slow.**
- **Government will develop a Transport Innovation Strategy in close collaboration with the ongoing energy innovation framework and the National Institute of Energy Technologies. This will comprehensively review current policies and explore others, such as second generation biofuels and hydrogen, where necessary.**
- **Government has embarked upon a programme to enhance consumer information on transport emissions and climate change. This will be informed by continuing current research into public attitudes and behaviours towards climate change and transport.**

CHAPTER 7

Planning for Large-Scale Energy Infrastructure

The planning challenge

7.1 The planning and consenting system for energy infrastructure projects[67] (e.g. new gas pipelines or gas storage, or investments in renewables, fossil fuel or nuclear electricity generation) is complex, with projects falling under a number of different consenting regimes (see table 7.1). These regimes have similar characteristics including:

- local government involvement;
- an assessment of the proposal against the local authorities' existing plans for development;
- public participation;
- an environmental impact assessment; and
- the potential for a public inquiry.

7.2 These elements are necessary to maintain a regime that is fair, transparent, has public support and that leads to better quality decision-making through local participation. However, these same elements can also create difficulties for participants, including uncertainty, delays and sometimes significant upfront costs.

7.3 Although energy policy is a reserved matter, most aspects of planning policy have been devolved, and in Scotland the planning system as a whole is devolved. Therefore, the relationship between Government and the Devolved Administrations is important in building frameworks for decision making for energy infrastructure that are fit for purpose and reduces delays and uncertainty across the entire UK.

7.4 The timely delivery of energy infrastructure plays an important role in maintaining the reliability of our energy supplies. Securing the necessary consents can be a major cause of delays for all types of energy projects. Recent experience shows these delays can be significant:

- the Scout Moor 65MW windfarm took 23 months to secure planning permission[68];
- Sizewell B, the most recently constructed nuclear power station, took 73 months to secure planning permission[69];
- the North-Yorkshire grid upgrade, a major high-voltage transmission line upgrade, took 96 months to secure planning permission[70]; and
- the proposed Presall gas storage facility to store 1020 million cubic metres of gas (20% of current storage capacity) was the subject of an application for planning permission in November 2003. A decision has yet to be made.

67 This report uses the term "energy planning system" to refer to the sum of all the different regimes under which energy infrastructure projects secure consents. In many instances, these consents will be deemed to grant planning permission.
68 Consent granted under the Electricity Act 1989, which also grants deemed planning permission.
69 As above.
70 As above.

7.5 On average, in England and Wales since 1990, where a planning inquiry has been held as part of the consenting process, large electricity projects have taken 36 months to secure consent[71]. There is an increasing need for major new gas supply infrastructure (as discussed below), and already there is growing evidence of increasing delays in the granting of consent. The need to tackle planning for both electricity and gas projects was emphasised in the responses to the Energy Review consultation.

7.6 There are several specific factors that contribute to the difficulties in securing the necessary consents, including planning permission[72] for potential developers:

- Individual energy projects are part of large national systems that provide benefits enjoyed by all communities. The areas in which they are located share in these benefits – and may also gain some economic advantage, for example, in terms of employment. But the benefits to society and the wider economy as a whole are much larger. These larger, wider benefits are not always visible to the specific locality in which energy projects are sited. Therefore, local opposition can often be strong. For certain energy development, e.g. gas storage facilities; there are some geological or environmental reasons for the siting of facilities.
- Without a clear Government policy highlighting the strategic national need of a particular type of development, it is difficult for an inspector to give sufficient weight to the national benefits when balancing these against local views. As a result, public inquiries can become embroiled in debates about national issues, rather than focusing on local issues relating to siting of the proposed development. For example, at the Sizewell B inquiry, only 30 of the 340 inquiry days were devoted to local issues.
- Energy projects often have important health and safety considerations. However, even though there are separate regulatory processes to ensure these risks are managed, discussions of these issues as part of planning inquiries can still be lengthy.
- A lack of time limits for the statutory process (both the inquiry and the final decision-making process) makes it difficult for developers to plan construction and procurement of key components, leading to further delays even once consent has been secured.
- Without a clear framework placing time limits for the statutory process, some inspectors will feel constrained as to their freedom to reduce the inquiry time, for example, by limiting the issues in the inquiry or by relying more on written representations. By trying to be more efficient, inspectors may feel they run the risk of being challenged for not having discharged their duties correctly.

7.7 The UK needs a planning framework for energy projects that takes account of both national and local issues, reaches timely decisions and provides more certainty of the duration of the process, while allowing the public to participate properly in the system.

7.8 As already mentioned in previous chapters, over the coming years, we need significant new investment in energy infrastructure:

- over the next two decades it is likely that we will need around 25GW of new electricity generation capacity; and

71 DTI Analysis; Electricity Development and Consents Team.
72 In some cases planning permission is "deemed" when other consents are granted, e.g. permissions under Electricity Act.

- as the UK becomes increasingly reliant on imported gas to meet electricity and heat requirements, the market will need to deliver new gas supply infrastructure such as gas storage and Liquefied Natural Gas (LNG) import facilities, in order to maintain reliable supplies to its consumers. The Government's role is to ensure that the right framework is in place to allow the market to deliver.

7.9 All new investment will need the appropriate consents under the planning system; see table 7.1 for some of the key consent regimes that comprise the planning system. An effective energy planning system is therefore critical if we are to facilitate timely investment in the infrastructure and capacity necessary to make further progress against our climate change and security of supply goals. This is particularly important for our climate change goals, given that planning delays can disproportionately affect low carbon investments such as onshore wind and nuclear power.

7.10 As well as affecting the timely delivery of projects already in the system, the uncertainty and delay associated with securing the necessary consents can make the UK less attractive as a destination for investors in energy infrastructure. A recent report by Ernst and Young on the relative attractiveness of the UK for investment in renewables found that the UK's position had fallen because of industry concerns about planning issues[73].

The need for radical, joined-up action on infrastructure planning

7.11 The barriers facing large energy infrastructure projects are not unique, and similar problems exist for other key infrastructure projects, for example airports and waste projects. Work is already underway within Government examining the difficulties for securing planning permission for all large infrastructure projects. The Eddington Study on the Future of Transport is examining the role of planning as a key factor affecting the delivery of important new infrastructure. The Barker Review is looking across the piece at the land-use planning system in England and Wales and its economic impacts.

7.12 The specifics of any changes to the planning system for energy projects will need to be looked at alongside the findings of this other work. However, Government is committing now to introducing fundamental change to the planning system in England and Wales for major energy projects, once the findings of the other Reviews are clear later this year.

7.13 Government also proposes a programme of work to begin immediately to tackle the planning barriers for developers of energy infrastructure. This programme will bring benefits in the short-term as well as enabling the timely introduction of radical change to be announced later this year. The programme of work is focussed on three key components of an effective planning system:

- A proper strategic context, set by Government for major energy infrastructure developments of national importance.

73 Renewable Energy Country Attractiveness Indices, Ernst and Young LLP, winter 2006.

- New and more efficient procedures for the consenting regimes to enable streamlined inquiries to focus on the relevant issues.
- Appropriate mechanisms to ensure timely action by decision makers to prevent delays at the end of the consenting process.

7.14 Furthermore, Government will work with the Devolved Administrations to ensure that across the UK, planning systems for energy projects can reduce risk and uncertainty for developers and others, while maintaining the openness, fairness and accountability of the current system.

Modernising the Scottish Planning System

7.15 Planning in Scotland is devolved and it is important to recognise that operation of the planning system in Scotland is distinct from that in England and Wales. It is governed by the Town and Country Planning (Scotland) Act 1997. While the Government and the Devolved Administrations share common high-level objectives for an efficient planning system there is no intention to promote a single UK-wide planning system or to alter arrangements for dealing with major energy generating developments under the Electricity Act, which, in Scotland, remains the responsibility of Scottish Ministers.

7.16 The planning system in Scotland is currently the subject of review and amendment proposed by the Planning etc. (Scotland) Bill 2006[74]. The objectives are to make it more efficient and inclusive, ensuring that community interests remain central to the system, but avoiding delays and uncertainty where possible.

7.17 The proposals in the Bill are radical; they fall broadly within the three key components highlighted above. Specific measures include:
- the ability to establish the need for a particular development that is of National Strategic Importance by identifying it as a National Development in the National Planning Framework;
- a hierarchy for development proposals requiring different application procedures for national, major and local developments. The intention is to make the planning system more fit-for-purpose, ensuring that responses to each application type are proportionate;
- the introduction of new procedure rules for inquiries (to follow the Bill in secondary legislation) allowing the decision-maker to determine the most appropriate means of resolving the matters in dispute. This would allow increased use of informal hearings and exchanges of written submissions and reserve formal inquiry sessions for those issues genuinely requiring adversarial examination; and
- the introduction of "processing agreements" for major applications which will establish a timetable for the determination of an application, to be agreed between the applicant and the planning authority.

7.18 We will work with the Scottish Executive closely as progress is made with the modernising of their planning regime.

7.19 Scottish Ministers will retain powers to grant consent for large electricity projects under the Electricity Act.

74 Further information is available from the Scottish Executive website http://www.scottish.parliament.uk/business/bills/51-planning/index.htm

TABLE 7.1: THE KEY ELEMENTS OF THE PLANNING SYSTEM FOR ENERGY INFRASTRUCTURE PROJECTS

	Project	Permission/Regulation	Authority
			England
ELECTRICITY INFRASTRUCTURE	Onshore power stations >50 MW and offshore power stations >1MW (Territorial waters) and >50 MW (REZ)	Electricity Act 1989 (s36)	Secretary of State for Trade and Industry
	Overhead power lines (>20kV)	Electricity Act 1989 (s37)	Secretary of State for Trade and Industry
	All other electricity infrastructure (e.g. small power stations, substations)	Town and Country Planning Act (1990) and equivalent Scottish legislation	Initial applications by local authorities. Appeals and call-ins by Secretary of State for Communities and Local Government. With substations jointly determined with Secretary of State for Trade and Industry
	Associated Compulsory Purchases of Land and Necessary Wayleave (granting access to land for developers of overhead lines)	Electricity Act 1989 (Schedules 3 and 4)	Secretary of State for Trade and Industry
	Gas or oil fired power station proposal of >10MW	Energy Act 1976 (s14(1))	Secretary of State for Trade and Industry
	Gas supply arrangements for gas-fired power station	Energy Act 1976 (s14(2))	Secretary of State for Trade and Industry
GAS	Underground Gas storage facilities (including surface infrastructure) for non-licensed gas transporters	Town and Country Planning Act (1990)	Initial applications by local authorities. Appeals and call-ins by Secretary of State for Communities and Local Government If application by a licensed gas transporter jointly determined with Secretary of State for Trade and Industry
		The Planning (Hazardous Substances) Act 1990 and equivalent Scottish legislation	Initial applications by local authorities. Appeals and call-ins by Secretary of State for Communities and Local Government

	Wales	Scotland
	Secretary of State for Trade and Industry	Scottish Ministers
	Secretary of State for Trade and Industry	Scottish Ministers
	Initial applications by local authorities. Appeals and call-ins by National Assembly.	Initial applications by local authorities. Appeals and call-ins by Scottish Ministers
	Secretary of State for Trade and Industry	Scottish Ministers
	Secretary of State for Trade and Industry	Secretary of State for Trade and Industry
	Secretary of State for Trade and Industry	Secretary of State for Trade and Industry
	Initial applications by local authorities. Appeals and call-ins by National Assembly.	Initial applications by local authorities. Appeals and call-ins by Scottish Ministers
	Initial applications by local authorities. Appeals and call-ins by National Assembly	Initial applications by local authorities. Appeals and call-ins by Scottish Ministers

TABLE 7.1: THE KEY ELEMENTS OF THE PLANNING SYSTEM FOR ENERGY INFRASTRUCTURE PROJECTS *continued*

	Project	Permission/Regulation	Authority
			England
GAS	LNG Import Terminals	Town and Country Planning Act (1990) and equivalent Scottish legislation	Initial applications by local authorities. Appeals and call-ins by Secretary of State for Communities and Local Government
	Underground Gas storage facilities (including surface infrastructure), but only for licensed gas transporters	Gas Act 1965	Secretary of State for Trade and Industry
	Gas Transporter Pipelines (pipelines that form the National Transmission System)	Gas Transporter Pipe-line Works (Environmental Impact Assessment) Regulations 1999	Secretary of State for Trade and Industry
		Town and Country Planning (General Permitted Development) Order 1998 and equivalent Scottish legislation	Local planning authority can request to Secretary of State for Communities and Local Government that permitted development rights should not be applied (which would force a separate planning application)
	Commercial Pipelines >16.093km	Pipelines Act 1962	Secretary of State for Trade and Industry
	Commercial Pipelines <16.093km	Town and Country Planning Act 1990 and equivalent Scottish legislation	Initial applications by local authorities. Appeals and call-ins by Secretary of State for Communities and Local Government

Stage 1 – Setting the strategic context

7.20 The first stage of developing a more effective planning system for energy projects involves Government taking proactive steps to set the right strategic context for applications for planning permission for energy infrastructure.

7.21 Government will take a number of steps to set the appropriate strategic backdrop for consideration of applications for the following energy infrastructure:

- renewable generation;
- combined heat and power (CHP);
- nuclear power;

	Wales	Scotland
	Initial applications by local authorities. Appeals and call-ins by National Assembly	Initial applications by local authorities. Appeals and call-ins by Scottish Ministers
	Secretary of State for Trade and Industry	Secretary of State for Trade and Industry
	Secretary of State for Trade and Industry	Scottish Ministers for pipes wholly in Scotland.
	Local planning authority can request to Welsh Ministers that permitted development rights should not be applied (which would force a separate application)	Local planning authority can request Scottish Ministers that permitted development rights should not be applied (which would force a separate planning application)
	Secretary of State for Trade and Industry	Scottish Ministers for pipes wholly in Scotland
	Initial applications by local authorities. Appeals and call-ins by National Assembly	Initial applications by local authorities. Appeals and call-ins by Scottish Ministers

- transmission line upgrades;
- gas supply infrastructure.

Renewable generation

7.22 Securing consent for renewables, and in particular onshore wind, can be an especially difficult process, with developers facing much uncertainty and a significant risk of delays.

7.23 According to industry statistics it takes an average period of 21 months for windfarms to secure planning consent under the Electricity Act regime[75].

75 BWEA – Onshore Wind: Powering Ahead, March 2006.

However, this figure does not represent the true extent of the delays because this does not include applications, which have been in the system for a significant time, but are yet to be granted consent. There are 24 projects, with a combined capacity of more than 1.2GW that have already been in the Electricity Act consent regime for longer than 21 months[76]. The majority of these are in Scotland, although it should be noted that there is already significant installed wind capacity in Scotland. In fact, in total, there is more than 11GW[77] of renewables capacity currently awaiting consent under the planning system

7.24 There are also significant delays experienced by smaller windfarms that are required to secure permission under the Town and Country Planning Act system, with decisions on average taking between 10 months in England and 27 months in Wales[78], against a target to determine 60% for all "major applications" within 13 weeks.

7.25 There are a large number of applications for wind projects – in the region of 200 currently being considered under both consents regimes[79] (Electricity Act and Town and Country Planning Act). As a result of this split across two consenting regimes, governments, central, devolved and local need clear objectives, whether as decision-makers or participants in the system, to enable the planning system to work effectively and to prevent avoidable delays.

7.26 Windfarm proposals have tended to attract controversy. There are a number of particular issues on which individuals and groups oppose proposals: for example on visual impact, impact on bird populations and increasingly the cumulative impacts of windfarms located relatively close together. Government believes that there is a need to set a clear context for all windfarm applications, whether under the Electricity Act or Town and Country Planning Act consent regimes.

7.27 Government policy on renewables was set out in the 2003 Energy White Paper, and Planning Policy Statement 22 (PPS22) was issued in England in 2004 to reflect the importance of renewables to local planning. Equivalent guidance has been issued in Scotland, via the National Planning Policy Guidance: Renewable Energy (NNPG6) in 2000, which is now subject of review and in Wales through the Technical Advice Note 8: Renewable Energy (TAN8). Government has decided to give greater clarity on the strategic issues relating to renewables. As such, we are publishing, as part of this report, a clear statement of need at annex D. This is to be used as a material consideration, alongside PPS22 in England and TAN8 in Wales.

7.28 The Scottish Executive is currently consulting on revised planning policies in its draft Scottish Planning Policy (SPP6)[80]. The Scottish Executive is committed to an ambitious strategy for the deployment of renewables in Scotland and is seeking to identify means of speeding up the consenting process, in order to bring forward achievement of its target for 40%

76 UK Wind Energy Database (UKWED), www.bwea.org/ukwed
77 Renewable Energy Statistics Database – http://www.restats.org.uk/2010_target.html
78 BWEA – Onshore Wind: Powering Ahead, March 2006.
79 UK Wind Energy Database, BWEA, www.bwea.org/ukwed
80 Draft SPP6 Renewable Energy states that the Scottish Executive is minded to require that certain new developments include on-site renewable energy equipment to reduce predicted annual CO_2 emissions by a minimum of 10%.

renewable electricity by 2020. It has also made clear that it does not see 40% renewable electricity as a cap, and will continue to consider renewables applications that go beyond this figure.

7.29 In March 2006, as part of the Climate Change Programme Review, Government committed to producing a Planning Policy Statement on Climate Change. This will set out how we expect "*participants in the planning process to work towards the reduction of carbon emissions in the location, siting and design of new development*"[81]. In developing this Statement, we will look at the scope for all types of low-carbon, distributed, including CHP, and renewable generation in delivering this objective.

7.30 We recognise the important role renewables can play and will ensure that this work builds on the statement of need for renewables set out in annex D of this publication, and confirms the need for renewable projects, of all sizes, to meet our climate change ambitions. This Planning Policy Statement will provide further support and guidance for decision makers in the planning system in England. Therefore, Government is committing to joint-working between DTI and DCLG to ensure the role of renewables is firmly embedded in the forthcoming Planning Policy Statement on Climate Change to be introduced in 2007. Government will work with the Devolved Administrations on equivalent guidance across the UK.

Combined Heat and Power (CHP)

7.31 The strategic context for CHP is set out in the existing guidance for developers making applications to construct power stations under the Electricity Act. This sets a requirement for them to "*explore opportunities to use CHP, including community heating, when developing proposals for new power stations*"[82].

7.32 In the 2003 Energy White Paper, Government committed to updating this guidance to provide developers with more clarity on how best to meet this obligation. This process started in 2004 with a consultation on the proposed guidance and Government has since been working with industry to more clearly establish the extent to which potential developers should explore CHP opportunities.

7.33 Government commits to publishing updated guidance, in consultation with the Devolved Administrations, on CHP for applications under s36 Electricity Act, by the end of this year. The guidance will include more information, with regularly updated heat maps, on developers' obligations to give full consideration to opportunities to develop CHP when proposing new power stations.

Nuclear power

7.34 Like onshore wind, nuclear power is especially affected by delays in the planning system. For instance, the important health and safety considerations associated with nuclear power attract significant public interest and can add considerably to the time taken to go through the consenting process. As

81 DEFRA Announcement as part of Climate Change Programme Review, 28th March 2006
82 Guidance on Background Information to Accompany Notifications under Section 14(1) of the Energy Act 1976 and Applications under Section 36 of the Electricity Act 1989

already mentioned, it took 73 months for the Sizewell B power station to secure planning consent[83].

7.35 Potential developers have made clear through the Energy Review consultation that without action to improve the planning process and to identify and address national issues in advance of public inquiries, they will not consider investments in new nuclear power stations.

7.36 Government is clear about the need for full public discussion and consideration on key issues associated with civil nuclear power including health and safety issues, and the weighing of the economic and other benefits against potential detriments. However, Government considers that these issues should be viewed in their appropriate context and should be addressed appropriately up front, in advance of any planning applications. This will avoid the same national issues arising as part of the consideration of every proposal, therefore appropriately allowing public inquiries to focus on local and other relevant issues.

7.37 Government is setting out a proposed framework for the consideration of the issues relevant to new nuclear build and the context in which public inquiries, as part of the planning process, should be held. This framework would be set out in a White Paper to be published around the turn of the year. To support the preparation of this White Paper, Government is consulting on the proposals outlined in annex A of this publication.

7.38 We are seeking views on a policy framework in which national strategic and regulatory issues are most appropriately discussed through processes other than the public inquiry. The inquiry should focus on the relationship between the proposal, the local plans and local environmental impacts. The inquiry should weigh up these issues against the national strategic or regulatory material considerations, which will have already been established. The inquiry should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.

Transmission line upgrades for all new generation investment

7.39 Given the current age of the UK electricity transmission and distribution system (the 'grid'), and the anticipated requirement for new generating capacity, it is likely there will have to be significant grid upgrades over the coming decades. Government believes that a grid upgrade, where it specifically relates to a new generating station should be considered as an intrinsic part of that project. Although separate applications must be made for the generating station and the grid upgrade, Government believes that both applications should be considered under the same inquiry, where practicable. This will help to reduce the risk associated with investment in both projects: generating assets should neither be stranded, nor should grid upgrades become superfluous.

7.40 Government will work with developers of generating stations and the transmission companies to encourage joint working to allow the consideration of both applications together. Government will also publish new guidance in England and Wales for applications under s36 Electricity Act to reflect this.

83 Deemed planning permission is granted for a development through securing consent under the Electricity Act 1989

7.41 Another important factor in the reliability of our supplies is the resilience of the electricity networks. Following the storms of October 2002, Government has been working with the electricity industry to see what lessons can be learnt and to better prepare for the future. One of the changes has been to amend the Electricity Safety, Quality and Continuity Regulations 2002 to include a requirement for the management of foliage near overhead lines to prevent interference with them or interruption to supply. The statutory instrument has been tabled for the relevant change to come into operation on 31 January 2009. A second change being pursued by Government is in connection with works on existing distribution lines to improve their resilience, for example by replacing bare wire conductors with insulated conductors. Government has therefore reviewed the overhead lines regime and believes a better balance can be struck between changes for which the full consent process is required and changes where a more flexible approach can be adopted. Government will consult on its proposals for new guidance on the consenting arrangements for overhead power lines later in 2006.

Gas supply infrastructure

7.42 Government has already stressed the importance of additional gas supply infrastructure, and announced a programme of work to reduce planning barriers for developers of gas supply infrastructure projects[84]. A key element of this work is to aid local authorities and those involved in making planning and consent decisions at a local level by clarifying the Government policy context and indeed the overriding national need for new gas supply infrastructure projects. This will help all parties to play a more effective role in the existing planning system. As part of this work, Government published a clear Parliamentary Statement of Need for additional gas supply infrastructure on 16 May 2006, to be held as a material consideration in all planning decisions.

Stage 2 – Introducing efficient inquiries

Electricity generation and overhead lines

7.43 Government, in consultation with the Welsh Assembly Government, will update the rules for public inquiries held under the Electricity Act in England and Wales for all generating stations with a capacity of greater than 50MW onshore, 1MW offshore, and for overhead electric lines. The new rules will incorporate the appropriate best practice, having regard for the rules introduced in England 2005 for major infrastructure projects that are granted planning permission under the Town and Country Planning Act[85].

7.44 The new rules are designed to provide all participants in the planning process with more certainty on how long the process will last. Specific elements include the introduction of timetabling for inquiries and the delivery of an inspector's report, and powers for the planning inspector to run a more efficient, streamlined inquiry, for example, through the introduction of concurrent hearings on different issues.

84 Speech by Alan Johnson during debate on security of supply, House of Commons, 12th January 2006.
85 The Town and Country Planning (Major Infrastructure Project Inquiries Procedure) (England) Rules 2005.

7.45 It will also increase the front-loading of procedures, making better use of pre-inquiry hearings where participants can discuss the relevant issues outside formal inquiry procedures with the expectation of reaching positions of common ground. A more efficient procedure, with fewer delays and uncertainties, should reduce the costs of taking part in the planning process for all participants[86]. Government is also considering other enhancements, including the practicalities of introducing more written procedures into planning inquiries.

7.46 A consultation on the detail of these changes will be launched later in 2006, with the intention of new rules being introduced in spring 2007. Other work is underway in Scotland to reform their planning system as discussed above.

7.47 A key factor in the timely running of an inquiry is the appointed inspector. Therefore, Government is also committing to making use of existing powers under the Electricity Act to appoint a high-powered inspector, for example a senior judge or QC, for the most complex and controversial proposals. Government considers that this should increase the likelihood that the full benefits of the new inquiry rules will be utilised effectively. Taking a more proactive approach in the appointment of inspectors should also reduce the time taken between a developer lodging an application and the start of an inquiry[87].

7.48 As highlighted above, the responsibility for the granting of consents in Scotland for large power stations and overhead lines is devolved to Scottish Ministers. The proposed changes above will apply to England and Wales only. Government is committed to working with all the devolved administrations to ensure that action is being taken to unlock and improve the efficiency of the consent regime and help allow renewable resources in the UK to be realised. The Scottish Executive will play an important role in the delivery of increased renewable generation, in part because the majority of proposals for onshore wind farm proposals are in Scotland (approximately 5GW)[88].

Gas Supply Infrastructure

7.49 As the production of our indigenous supplies of gas continues to decline and the UK becomes more reliant on imported sources of gas for both electricity and heat, there is an increasing need for gas supply infrastructure, such as gas storage projects and LNG import facilities.

7.50 As set out in the chapter on oil, gas and coal, new gas supply infrastructure will play an important role in maintaining a reliable supply of energy for the UK. Securing consent is a key factor in the timely delivery of such projects. Delays in securing consent that result in gas infrastructure not being delivered, or arriving later than needed could result in price rises and price volatility for UK consumers, because of the increased risk of gas shortages at moments of high demand (e.g. a particularly cold winter).

86 According to industry, the direct inquiry costs for the Sizewell B inquiry for the developer alone were £30 million.
87 For example, the inquiry for the Scout Moor windfarm began over one year after the application was submitted.
88 UKWED, British Wind Energy Association.

7.51 However, current uncertainty over securing the necessary consents is increasing, and there is growing evidence of "in-principle" objections from local planning authorities to necessary gas supply infrastructure, as opposed to objections based on the specifics of the proposal. As well as delaying the commissioning of projects already in the system, this uncertainty increases project costs and reduces the attractiveness of the UK investment market for future developments.

7.52 Ensuring the UK has the right gas supply infrastructure requires a regulatory and planning regime that is fit for purpose and minimises risks and uncertainties for developers, while maintaining the ability for local participation. Currently, investors are faced by a mix of local planning controls overseen by the Department for Communities and Local Government and the Devolved Administrations, specialist consent regimes administered by the Department of Trade and Industry and again the Devolved Administrations. These regimes have evolved over time and have not been redesigned to reflect the major changes in the UK gas industry, nor the technological developments in this area.

7.53 Government will consult on the streamlining and simplification of the consenting regimes for gas supply infrastructure projects this Autumn. Government will work closely with the Devolved Administrations in this exercise, recognising the devolved responsibilities in the area of gas consenting regimes. This is in line with the commitments made by the Secretary of State for Trade and Industry earlier this year[89].

7.54 There is also work underway to prepare for the establishment of an offshore consent regime for new gas storage projects and LNG offshore unloading. Legislation for this offshore work will be taken forward by Government when parliamentary time permits.

Stage 3 – Timely decision making

7.55 The question of final decision-making is a particular issue for all major infrastructure projects and, as already mentioned, work is underway across Government to consider this issue, both in the Eddington Study on the future of transport and, in England and Wales, the Barker Review of Land Use Planning.

7.56 There are a number of options that Government is considering on how best to ensure that the decision-making stage of the consenting process for energy projects does not subject the developer to further, unnecessary delays.

7.57 Government will ensure that there is a joined-up approach, working with the Devolved Administrations, on this issue and will bring forward proposals on options to ensure appropriate and predictable timings for decisions on applications for energy developments. A future announcement will be made later this year in the light of other cross-Whitehall work on planning.

89 Speech by Alan Johnson during debate on security of supply, House of Commons, 12th January 2006.

Measures to introduce new planning system for Major Energy Infrastructure

- **Government is committing now to introducing fundamental change to the planning system for major energy projects once the findings of the other Reviews (Eddington Study and Barker Review) are clear, later this year.**
- **Government will work with the Devolved Administrations to ensure that across the UK, planning systems for energy projects can reduce risk and uncertainty for developers and others, while maintaining the openness, fairness and accountability of the current system.**

Stage 1 – Setting the Strategic Context

- **Government is publishing today a statement of need on renewables, restating our commitment;**
- **Government will ensure renewables are firmly embedded in the forthcoming Planning Policy Statement on Climate Change. Government will work with the Devolved Administrations on equivalent guidance across the UK;**
- **Government will publish new guidance in England and Wales on CHP, later in 2006, for applications under s36 Electricity Act. It will provide more information on developers' obligations to give full consideration of opportunities to develop CHP;**
- **Government will publish generic guidance in England and Wales on s36 Electricity Act, including information on co-operation between developers and the transmission companies about joining-up on applications;**
- **Government will consult on new guidance in England and Wales on the consenting arrangements for reinforcements to existing overhead power lines later in 2006; and**
- **Government is launching today a consultation on a policy framework for new nuclear build.**

Stage 2 – Introducing Efficient Inquiries

- **Government will introduce new inquiry rules for applications under the Electricity Act, in Spring 2007;**
- **Government is committed to appointing a high-powered inspector for the most complex and controversial energy proposals; and**
- **Government will consult on options for the streamlining and simplification of the consenting regimes for gas supply infrastructure projects.**

Stage 3 – Timely Decision Making

- **Government will undertake further work on options to ensure appropriate and predictable timings for decisions on applications for energy developments. An announcement will be made later this year in the light of other cross-Whitehall work on planning.**

CHAPTER 8

Meeting Our Goals

Making progress towards our Energy White Paper goals

8.1 In this report we underline the scale of the challenges we face in making further progress towards our Energy White Paper goals. We will need to take action across all fronts if we are to address these problems. Government policy needs to deliver the right incentives for individuals, businesses and energy suppliers to respond to these challenges in their day-to-day activities.

Impact on carbon emissions

8.2 The proposals in this report, together with other proposals announced since publication of the new Climate Change Programme in March this year, will save 19.5 – 25.3 million tonnes of carbon (MtC) by 2020.

8.3 The table below sets out the carbon impact of each measure; a range is quoted to reflect uncertainty over the timing and effectiveness of the new policies.

TABLE 8.1: CARBON IMPACT OF GOVERNMENT MEASURES ANNOUNCED SINCE THE 2006 CLIMATE CHANGE PROGRAMME REVIEW (EXCEPT WHERE DENOTED†)

	MtC abated in 2020
Better Billing	0 – 0.1
Changes to the Renewables Obligation[1]	0.7 – 1.5
EU Emissions Trading Scheme[2]	8
More energy efficient products[3]	2
Nuclear new build[4]	0 – 1.1
Renewable Transport Fuel Obligation	0.3 – 1.1
New measure for achieving carbon savings from large non-energy intensive organisations	1.2
Successor to EU voluntary agreements on new car fuel efficiency[5]	1.8 – 2.1
Continued commitment on energy suppliers to 2020[6]	3.0 – 4.0
†Continuation of building regulations 2005[7]	2.5 – 3.0
Carbon neutral government[8]	0 – 0.8
Carbon neutral developments[9]	0 – 0.4
Total	*19.5 – 25.3*

Notes
1 These carbon savings are additional to those from the existing Renewables Obligation and derive solely from the proposed changes to the Obligation
2 This value is based on the proposed reduction in carbon allocation in phase II of the EU ETS.
3 Products policy is delivered by a package of measures, including, labeling, minimum standards and voluntary agreements. This 2MtC saving is net of products delivered via EEC or the new measure for achieving carbon savings from large non-energy intensive organisations.
4 The scale of new nuclear capacity and the timing of its commissioning will depend on commercial investment decisions. For illustrative purposes this table assumes that between 0 and 1.6 gigawatts of new capacity are in operation by 2020.
5 These estimates assume that the level of the Renewable Transport Fuel Obligation rises to 10% by 2015. This figure is used merely for illustrative purposes and does not prejudge later UK decisions on the appropriate future level of the obligation.
6 Government is committed to maintaining a household obligation on suppliers in some form until at least 2020. The level of ambition from 2011 should at least be equal to that under EEC3, delivering 3-4 MtC by 2020.
7 The figures here are for contributions from Building Regulations for 2010-2020 and have not been included in our base line assumptions. The figures reflect the additional savings from new buildings, refurbishments and boiler and window replacements between 2011-2020 due to Building Regulations.
8 Policy was announced by Defra in June 2006.
9 Policy was announced by DCLG in May 2006.

8.4 There are further measures which could save significant amounts of carbon. First, it is already a UK objective to include aviation in the EU ETS[90]. Second, the UK has asked the European Commission to seriously consider including surface transport in the EU Emissions Trading Scheme. This could save 4-7 MtC by 2020. Carbon capture and storage (CCS) could in principle bring further savings. If a 500MW demonstration project of coal plant with CCS went ahead, this could save 0.3 MtC in 2020. We are also working to remove regulatory and other barriers to CCS, and if CCS ultimately proved commercially viable, very significant carbon savings might become possible beyond 2020. Beyond 2020, if further nuclear power stations are built, we could save around 0.7 MtC for each GW of capacity installed[91].

8.5 There are a number of other factors which will affect the progress we make in achieving carbon savings over the next two decades:

- fossil fuel and carbon prices as well as attitudes to climate change that could have a significant impact on emissions. High fossil fuel prices could result in reduced energy consumption; high carbon prices could incentivise a faster rate of low carbon technology development; and consumer demand could stimulate the market for environmentally friendly goods and services;
- the potential for life extensions for existing nuclear plants, early applications of carbon capture and storage or a higher penetration of distributed generation technologies; and
- clarifying our carbon framework and our position on renewables and nuclear to improve the investment environment, and helping to build investor confidence in taking long term decisions which are consistent with our goals.

8.6 In the 2003 Energy White Paper, projections showed UK carbon emissions reaching 135 MtC in 2020. We said that in order to demonstrate our leadership in tackling climate change and make real progress towards our 2050 carbon reduction goal we would need to make a reduction in emissions by 15 – 25 MtC to 110 – 120 MtC by 2020.

8.7 However, since 2003, emissions have risen on the back of strong economic growth and higher fossil fuel prices that have been favourable to coal-fired power generation. New projections[92] suggest that UK carbon emissions will reach 146 MtC by 2020 on the basis of current policies. So we would now need to make bigger cuts in emissions of around 25 – 35MtC in order to reduce emissions to 110 – 120 MtC by 2020.

8.8 Table 1 above shows the impact of the proposals in this report, including those announced since the 2006 Climate Change Programme Review, as a reduction of up to 25 MtC in 2020. Together with further potential reductions referred to in paragraph 8.4, these ambitious proposals are a significant step in the right direction, getting us on course to achieve real progress in emissions reductions by 2020 and on the right path to achieving our goal of cutting the UK's CO_2 emissions by some 60% by about 2050. In this report the Government provides a framework for long-term policy; it is not the last step. We will develop and implement further measures in the years ahead and strengthen the use of policy measures already in place. Tackling climate change requires action across

90 This would produce carbon savings within the context of the EU scheme. Exactly how much of this would be attributable to the UK would depend on how international aviation emissions are allocated to national inventories under any future international agreement.
91 Assumes 1GW of CCGT capacity is displaced.
92 See annex C.

all departments, achieving carbon reductions through different technologies and across all sectors of the economy towards our 2050 goal.

8.9 The Government is committed to keeping under review progress towards our climate change goals and reporting on this annually to Parliament.

8.10 To drive forward progress, we are proposing to establish an Office of Climate Change. This will be a shared resource, reporting to ministers across Government. The Office will have a vital contribution to make ensuring that the analysis and policy work going on across Government is coherent and supports our overall strategy.

8.11 In the 2006 Climate Change Programme Review we said that the idea of carbon budgets would be considered by the Stern review of the economics of climate change, and that this analysis would influence our work. The Stern Review has carried out an initial assessment of carbon budgeting. And we shall continue to study the merits of carbon budgeting as a means of helping to deliver our goals.

Impact on security of supply

Framework for electricity generation

8.12 There has been much focus in this report on removing barriers to investment in low carbon technologies. We are also reinforcing our commitment to a carbon price, taking steps to enable nuclear new build and boost renewables. These measures should increase the proportion of low carbon technologies in the electricity generation mix and tend to reduce the share of gas-fired generation.

8.13 If we assume that our proposals to incentivise low carbon electricity generation will lead to the displacement of gas fired power generation, they would reduce the share of gas in our generation mix by up to 10% and reduce gas consumption in 2020 by up to 5 billion cubic meters (bcm) per year. This would be part of the overall savings in gas consumption referred to below.

Gas security of supply

8.14 We have identified increasing reliance on gas (at a time of falling UK Continental Shelf (UKCS) production) as one of the main energy policy challenges faced by the UK. It will be for producers and consumers to decide how much gas is consumed in the UK. However, assessing the impact of proposals in terms of reduced gas consumption is one way of measuring their impact on security of supply.

8.15 The proposals in this report could reduce gas consumption by around 12 to 20 bcm by 2020, which currently represents about 11–17% of our expected 2020 consumption.

8.16 Our proposals also improve the framework for investment in the UK Continental Shelf (UKCS), potentially delivering significantly higher oil and gas production – up to an extra 1 million barrels of oil equivalent (boe) a day in 2020 – and reducing our import requirement. About half of this extra production would be gas and half would be oil. The resulting cut in gas imports would be over and above the reduction explained in the previous paragraph.

8.17 Moreover, we are consulting on the effectiveness of our current framework for gas security of supply to assess whether it is sufficiently robust to cover the risks associated with the move to increased UK gas import dependence.

Impact on competitive markets

8.18 In recognition of our increasing reliance on global energy markets, we are pursuing a strong international agenda to promote more open and competitive markets. And we will continue our drive for EU energy market liberalisation and integration, working with the European Commission to enforce and strengthen internal market legislation and to make full use of European competition rules to tackle anti-competitive practices. This will help improve the effectiveness and transparency of international energy markets and address anti-competitive behaviour in Europe, ensuring more reliable UK access to energy markets.

8.19 At home, our proposals demonstrate our continued commitment to competitive energy markets; in clarifying our position on nuclear new build, renewables and our carbon framework we are reducing uncertainty, improving the environment for investors. We are also improving the information available for investors, users of energy and government so that both investment and policy decisions are based on the most robust available information.

Impact on fuel poverty

8.20 Rising fuel prices mean that fuel poverty remains a major long-term challenge. But our package of measures does not greatly add to this challenge. We can and will take steps to better target existing support: by getting details of the help that is available to those who need it most; ensuring energy is competitively priced; and enhancing energy efficiency.

Impact on energy prices

8.21 Carbon abatement can be costly and can increase energy prices. Acting internationally is the best way to minimise these impacts. The existence of the EU ETS is having an impact on electricity prices in the UK – and elsewhere – because electricity generators will factor in the cost of carbon allowances. The size of this impact depends on the scale of effort to deliver carbon savings across the EU and the related abatement costs. At the current EU ETS carbon price of around €15, the impact on electricity prices could reach around 20% for industrial and 10% for household consumers. The overall effect will also depend upon the response of energy demand.

8.22 We have taken cost effectiveness into account in developing policies to reduce carbon and improve security of supply, and have examined how to reduce barriers to current policies to deliver greater carbon savings at little or no extra cost. We therefore expect the impact on energy bills to be small. We will undertake a full analysis of the impact of our proposals in the forthcoming White Paper.

8.23 Recent analysis has identified that in the medium term, the costs of mitigating climate change are likely to be of the order of 1% of global GDP,

with some studies pointing to ancillary benefits from improved efficiency and more innovation, so that the cost may eventually be much less than this[93].

Developing the right long-term framework for delivering our goals

8.24 Over the long term we must continue to make progress in reducing carbon emissions on a path consistent with our 2050 goal. We will also need to adjust to the global depletion of fossil fuels. The actions we need to take to address these long term challenges are closely linked.

8.25 There is a range of paths consistent with delivering secure affordable supplies, consistent with our carbon goal for the long term. Factors which shape these are:

- **The actions of others** – our 2050 carbon goal is couched in terms of a contribution to international action to deliver the carbon savings required to make a real impact on climate change. Commitment by others is vital for tackling the global problem of carbon dioxide emissions and climate change; if we act alone we risk undermining the competitiveness of our economy. The speed with which we move to a low carbon economy will also be determined by the actions of energy supplier countries to extract reserves in a timely and efficient manner affecting the availability and price of fossil fuels.
- **Market developments** (e.g. fossil fuel prices) – have encouraged coal use in electricity generation but could in the longer-term result in reduced energy consumption; high carbon prices could incentivise faster development of non-fossil fuel, low carbon technologies.
- **Technological developments** – given the potential for technological development over the longer term to help us deliver our goals at a lower cost than today, we have always been mindful that a straight-line path to our 2050 carbon goal may not be the most cost-effective path.

8.26 Many of the above are unknown. We need to take action now without locking ourselves into a position which risks proving inefficient in the light of future developments. Key to this is our commitment to keep under review progress towards our climate change goals so that our energy policy framework enables us to take full advantage of opportunities to make progress towards our goals e.g. through harnessing new technologies.

8.27 Government intervention may be necessary to help make markets take account of, and efficiently respond to, our energy policy goals. The use of economic instruments, such as taxes and trading schemes, to incentivise behaviour that protects or improves the environment, and to deter actions that are damaging to the environment, is one option to enable environmental goals to be achieved at the lowest cost and in the most efficient way. Over the past decade, Government has introduced a range of economic instruments in pursuit of environmental objectives, and we will continue to explore options for introducing new ones, taking account of all economic, social and environmental objectives.

93 Work carried out for 'The Government's Review of the Economics of Climate Change – led by Sir Nick Stern and due to report Autumn 2006.

Harnessing technology to deliver our goals

8.28 Advances in technology have the potential to make genuine step-changes to meeting our goals across the entire energy system: generation/production, transport/transmission, storage and use largely through increases in efficiency (demand reduction) or alternative (non carbon) energy sources.

8.29 The development of new energy technologies will be crucial in addressing these challenges at reasonable cost. Work carried out for the 2003 Energy White Paper estimated the costs of meeting the 60% carbon reduction goal to be two to three times higher where innovation failed to reduce the costs of new low carbon technologies below their expected levels in 2010. This analysis is in the process of being updated.

8.30 However, we do not know which technologies will be most effective in delivering our long-term energy goals as many are at an early stage of development and so their technical and commercial success is still uncertain. It is important, therefore, to ensure that a wide-range of new energy technologies is developed on a global scale.

8.31 Some of the areas where we hope to harness the potential of technology are:

- **improving the efficiency of the electricity system** – though reliable, the current electricity system is very inefficient both because the capacity of the system is rarely fully employed (only during periods of peak demand) and a large proportion of the heat generated by large power stations is wasted into the atmosphere;
- **low carbon transport systems** – based upon new and emerging technologies, principally hydrogen, advanced biofuels and hybrid technologies. These will require significant further development to realise their full potential for carbon savings. For example, fuel cell development will be necessary to maximise the use of hydrogen; and
- **nuclear fusion** – nuclear fusion offers the potential to provide a new major source of energy using basic fuels which are abundant and widely available (hydrogen/deuterium from water and lithium). A fusion power station would create no greenhouse gases during its operation and no long-lived radioactive waste. The goal of the international fusion research programme, starting with the construction of ITER – the experimental fusion reactor to be built in France – is the demonstration of full-scale power generation in a prototype power plant within 30-35 years.

8.32 The UK is already playing its part. Total government spend on R&D into renewable and low carbon energy will be over £500m between 2002 and 2008, delivered through the Research Councils and the Government's Technology Programme. The publicly funded, independent Carbon Trust also supports industry-led R&D. Also, for many technologies, the more expensive demonstration stage of innovation is a key barrier. DTI has a range of capital grant programmes totalling £300m which support promising technologies to move through this phase of development to commercial deployment.

8.33 Government also recognises the crucial role that market influence has on innovation and we are bringing forward proposals to restructure the Renewables Obligation to further encourage emerging energy technologies.

8.34 We recognise the international nature of these challenges and so we are emphasising greater international collaboration, through the European Union and the International Energy Agency as well as bilateral agreements, such as that with China on carbon capture and storage.

8.35 The private sector must also play a key role in the innovation process. Aspects of the Government's work targeted at strengthening the investment framework are important here if we are to move new energy technologies rapidly from the laboratory to the market.

8.36 In recognition of the importance of collaboration between the public and private sectors in technological advancement, we formed the Energy Research Partnership at the end of 2005. The Energy Research Partnership brings together high-level representatives from Government, industry and academia in the UK. It provides leadership for energy research and innovation, including improving understanding of what drives business investment in energy R&D.

8.37 In Budget 2006, we announced the intention to create a major new public-private funding initiative promoting energy R&D – the National Institute for Energy Technologies (NIET) (see box 8.1).

BOX 8.1: THE NATIONAL INSTITUTE FOR ENERGY TECHNOLOGIES

The National Institute for Energy Technologies will bring a new level of focus, ambition and industrial collaboration to the UK's work in the field of energy science and engineering, and will exploit the UK's potential to be a world-leader in energy technologies.

It will have a "design life" of a finite period, probably a decade. The Institute will work to objectives set in consultation with funders, including industry contributors, and it will have a strong public-private governance structure. We anticipate that the initial focus of the Institute will be on research and development, although it may develop a role in demonstration and deployment. The Institute is expected to operate with a "hub" with a high calibre Director and "spokes" through which the main research projects/activities are undertaken. Industry partners will be free to undertake joint projects on a voluntary basis using their own funds.

The Chancellor's announcement stated that the Institute might, in due course, have a budget of £100m p.a. The Energy Research Partnership, under the joint chairmanship of Paul Golby, Chief Executive of E.On UK and Sir David King, the Government's Chief Scientific Adviser, has committed itself to raising substantial sums of private investment. EDF Energy, Shell, BP and E.On have already announced their intention to be involved. We envisage that the Institute will hold funds in a single "core" pot from all funders. Funding will be allocated competitively, using existing facilities where possible.

We are working with the companies to develop the proposal and will shortly publish an outline prospectus for the Institute in order to seek broader views and to gauge wider interest.

CHAPTER 9

Implementation

Overview

9.1 In this report, we have set out a programme of action to make further progress towards our energy goals to 2020 and beyond. The proposals include measures that we will bring forward shortly, some where we will issue consultations and others where we will undertake further analysis.

9.2 We have engaged closely with a wide range of organisations as part of the Energy Review consultation. We will need continued close engagement to ensure we implement our proposals in the most effective way. Delivering secure, clean and affordable energy will need all of us to take action – business, individuals and Government.

Better Regulation

9.3 The proposals set out in this report will be taken forward in accordance with the principles of Better Regulation. These state that regulation should be:

- **proportionate** – to the risk;
- **accountable** – to ministers and Parliament, to users and the public;
- **consistent** – so that people know where they stand;
- **transparent** – open, simple and user-friendly; and
- **targeted** – on the problem, with minimal side effects.

9.4 Some of the measures we are putting forward now, for example on planning, are intended to simplify regulation and reduce uncertainty by removing costs and delays from the current system. Others, for example the proposed changes to the Renewable Obligation, are intended to deliver better ways of meeting our objectives without increasing costs to business or consumers.

Sustainable Development

9.5 The principle of sustainable development requires that social, economic and environmental costs are considered in policy appraisal so that the welfare of future generations is not compromised. Sustainable Development principles are at the heart of the four UK energy policy goals, set out in the 2003 White Paper.

9.6 The shared principles of sustainable development in the UK apply to the Government, Scottish Executive, Welsh Assembly Government and the Northern Ireland Administration. For a policy to be sustainable, it must respect all five principles:

- living within environmental limits;
- ensuring a strong, healthy and just society;
- achieving a sustainable economy;
- using sound science responsibly; and
- promoting good governance.

9.7 The policy package set out in this report is expected to reduce carbon emissions by around 19 – 25 MtC by 2020.

9.8 As individual proposals are further developed, we will address the social, economic and environmental impacts as part of relevant Regulatory Impact Assessments.

Implementation

9.9 Some of the measures highlighted in this report re-confirm government policy or describe measures that have already been announced (for example the work of the Department for Communities and Local Government on energy efficiency in buildings).

Next Steps

Carbon Emissions Reductions

Commitment to a carbon price: the Government is committed to there being a continuing carbon price signal which investors take into account when making decisions. This is particularly important given the scale of new investment required in UK electricity generation capacity. The EU ETS is here to stay beyond 2012 and will remain the key mechanism for providing this signal. The Government will continue to work with its international partners to strengthen the EU ETS to make it more effective. We will 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 to investors.

Energy Efficiency

Improved Billing: we will be consulting with industry in autumn 2006, on providing historic information on electricity and gas bills and will consider further improvements.

UK Energy Performance Commitment (EPC): we will put forward a proposal for a mandatory emissions trading scheme, alongside other options for achieving our carbon reduction aims in the large non-energy intensive sector, and will invite views later in 2006.

Code for Sustainable Homes: we will announce the 5 Levels for the Code for Sustainable Homes later this year. All government-funded housing will be required to reach at least Level 3 – significantly more energy efficient that current Building Regulations.

Design for Manufacture Competition: English Partnerships (EP) will announce details of the second phase of the Design for Manufacture competition, using six sites across the country. EP will challenge the industry to build low cost, low carbon and zero carbon homes, looking at the whole developments.

We will conduct a feasibility study for delivering a low carbon Thames Gateway over the next ten years. We will explore the scope for the Thames Gateway to become a model site for developing emerging technologies, and eventually moving towards carbon-neutrality.

Review of Permitted Development Rights for Microgeneration: Department for Communities and Local Government will consult on changes to the General Permitted Development Order in the autumn. We aim to ensure that, so far as possible, all microgeneration is exempted from the need for a planning application.

Energy Efficiency Commitment: we will consult this summer on whether to extend the range of measures allowed under the third phase of the Energy Efficiency Commitment, considering microgeneration and measures that affect consumer behaviour.

Distributed Energy

Review of incentives and barriers: the Government and Ofgem will lead a comprehensive review of the incentives and barriers that impact on distributed electricity generation. This Review will report in the first half of 2007.

Foresight Project: the Government will undertake a Foresight project on sustainable energy management and the built environment. The project would consider the potential future role and relationship of centralised and decentralised energy generation in delivering the UK's long-term energy goals. In order to do this it would look at scientific, technical and economic issues including: future systems for generating heat and power that are low carbon and distributed; transmission and distribution networks; and demand management. Demand management would range from reducing use of energy in buildings through materials and intelligence, to exploring behavioural, attitudinal and information barriers to changes in behaviour. The project would report its findings in autumn 2008.

Oil, Gas and Coal

New arrangements for providing improved information and projections for energy supply: we will introduce new arrangements for the provision of a forward-looking energy market information and analysis pertaining to security of supply, led from the DTI and working with key energy market players, to brigade in one place relevant data and analysis on adequacy of future energy supplies, presenting long-term scenarios of future supply and demand, and identifying in a timely fashion areas where policy may need to be reviewed.

A Coal Forum: the Government will set up a Coal Forum to bring together producers, coal-fired generators and other interested parties to help them find solutions to secure the long-term future of coal-fired generation and UK coal production.

Gas security of supply: the Government will consult in autumn 2006 with both industry and consumers on the effectiveness of current gas security of supply arrangements, their robustness as we move to higher dependence on gas imports, and if new measures are needed to strengthen them.

Investment in UK oil and gas production: the Government will work with industry to boost investment in the UK Continental Shelf (UKCS) over the next ten to fifteen years.

Electricity Generation

Renewables

Renewables Obligation (RO): we are proposing to extend the level of the Renewables Obligation up to 20%, when justified by growth in renewables; and consult on 'banding' the RO to give more support to emerging technologies in autumn 2006. If, following this, the RO is to be banded, then we will consult further on the implementation.

We will also be taking forward planning proposals that will impact on large-scale renewables projects (see "efficient and streamlined" inquiries section below), and will be monitoring the progress being made by Ofgem and the transmission companies in resolving grid-related obstacles to the growth in renewables.

Environmental Transformation Fund: a new fund will be established to support renewable energy and other non-nuclear low carbon technologies. Details will be announced in the 2007 Comprehensive Spending Review.

Cleaner coal and carbon capture and storage

Carbon Abatement Technology strategy: we will formally launch the first call for proposals worth £10m under the strategy in autumn 2006, with a focus on the pre-commercial demonstration of key components and systems to support carbon abatement technologies.

Carbon Capture and Storage (CCS): the next step would be a commercial demonstration of CCS, if it proved to be cost-effective. Following HM Treasury's recent consultation on CCS, we will do more work on the potential costs of such demonstration projects. A further statement will be made in the Pre-Budget Report.

Legal & Regulatory Framework: the Government will continue urgent work to provide the legal and regulatory basis for CCS in the UK, and to enable CCS to benefit from the EU Emissions Trading Scheme.

Nuclear

Proposed policy framework for new nuclear power: we are setting out a proposed framework for the consideration of the relevant issues and the context in which planning inquiries should be held. This framework would be set out in a White Paper to be published around the turn of the year. To support preparation of this White Paper, the Government is consulting on the proposals outlined in Annex A of this document. The Health & Safety Executive and the Nuclear Installations Inspectorate plan to issue guidance towards the end of 2006.

Planning for large scale energy infrastructure

Strategic context

Renewable generation: the Government will ensure renewables are at the heart of the forthcoming Planning Policy Statement (PPS) on Climate Change. We will consult on the draft Planning Policy Statement around the turn of the year. The new PPS will make clear that the location and design of new developments should strongly promote the reduction of carbon emissions.

CHP Guidance: the Government will publish new guidance on Combined Heat & Power, later in 2006, for applications under section 36 of the Electricity Act. It will provide more information on developers' obligations to give full consideration of opportunities to develop CHP.

Improved planning applications: the Government will consult on guidance for section 36 Electricity Act applications around the end of 2006, including information on co-operation between developers and the transmission companies about joining-up on applications.

Nuclear generation: the Government is launching a consultation on a policy framework for new nuclear build, which will lead to the Energy White Paper around the turn of the year.

Efficient and Streamlined Inquiries

New inquiry rules: the Government will introduce new inquiry rules for applications under the Electricity Act. We will consult in autumn 2006 with a view to introducing new inquiry rules in spring 2007.

Simplification for gas infrastructure: the Government will consult, in autumn 2006, on options for the streamlining and simplification of the planning process for gas supply infrastructure projects.

Predictable timings for final decision-making: the Government will undertake further work on options to ensure appropriate and predictable timings for decisions on applications for energy infrastructure. An announcement will be made later this year in the light of other cross-Whitehall work on planning.

Transport

Renewable Transport Fuel Obligation: the Government will be consulting on enhancements to the RTFO in early 2007.

EU car fuel efficiency Voluntary Agreements: we will consult with industry on options to replace the current Voluntary Agreements when they expire in 2008/09. We will explore all options including mandatory measures with trading.

Surface transport in the EU Emissions Trading Scheme (EU ETS): the Government will continue to participate in the European Commission's Review of the EU ETS and press for serious consideration of the inclusion of surface transport.

ANNEX A

Consultation on the Policy Framework for New Nuclear Build

Introduction

In the 2003 Energy White Paper the Government recognised that nuclear build might be necessary if the UK is to meet its carbon targets, but it concluded that the economics at the time made it unattractive. A commitment was made that:
"before any decision to proceed with the building of new nuclear power stations there will need to be the fullest public consultation and the publication of a further White Paper setting out the Government's proposals".

The Government has considered the role of nuclear generation. The consultation document "Our Energy Challenge: securing clean, affordable energy for the long-term" set out information about nuclear power amongst other issues and asked whether there were any particular considerations that should apply to nuclear as the Government re-examines the issues bearing on new build, including long term liabilities and waste management, and if so how the Government should address them.

After a period of public consultation and analysis, the Government has concluded that:
"Nuclear power is a source of low carbon generation which contributes to the diversity of our energy supplies. Under likely scenarios for gas and carbon prices, new nuclear power stations would yield economic benefits in terms of carbon reduction and security of supply. The Government believes that nuclear has a role to play in the future UK generating mix alongside other low carbon generating options. Evidence gathered during the Energy Review consultation supports this view."

However, it will be for the private sector to take decisions on proposing new power stations, based on commercial considerations.

Having reached the position that nuclear has a future role, this document sets out how the Government intends to create a policy framework under which developers will be able to make proposals for new nuclear build, that will be published in a forthcoming Energy White Paper. This White Paper will set out the Government's policy on new nuclear build.

Planning is a devolved matter, and powers to grant consent for large power stations in Scotland (under the Electricity Act) have been executively devolved. Therefore it will be for Scottish Ministers to decide on the relevant issues and approach to applications made to them under the Electricity Act regime.

The Government is seeking views on the following proposal:

BOX A1

A policy framework for new nuclear build should be developed. It would include a nuclear "Statement of Need" and set out that national strategic and regulatory issues are most appropriately discussed through processes other than the planning inquiry.

The planning inquiry should focus on the relationship between the proposal and the local plans, and local environmental impacts. The inquiry should address these issues in the context of the national strategic or regulatory material considerations, which will already have been established. The inquiry should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.

The deadline for responses is **31st October 2006.**

This document includes material that it is envisaged would be incorporated within the policy framework and the statement of need. In the light of the views received, the policy framework will be formalised in a White Paper and form a material consideration for future planning inquires into new nuclear build proposals. In finalising the text of the statement of need, the Government will, of course, take into account comments received during the consultation.

This document also includes background information to support these changes to the regulatory framework.

There will be a separate consultation on more detailed changes to the inquiry rules under section 36 of the Electricity Act, which apply to all onshore power stations over 50MW and 1MW offshore. This will contain specific proposals that will support the policy framework outlined in this paper.

How to respond

When responding please state whether you are responding as an individual or representing the views of an organisation. If responding on behalf of an organisation please make it clear who the organisation represents and, where applicable, how the views of members were assembled.

A response can be submitted by email or by letter to:

Energy Review: Nuclear Policy Framework
Department of Trade and Industry
1 Victoria Street
London
SW1H 0ET

Email: nuclearpolicyframework@dti.gsi.gov.uk
Website: **www.dti.gov.uk/energy/review**

You can make copies of this document without seeking permission.
An electronic version can be found at **www.dti.gov.uk/energy/review**

Confidentiality and Data Protection

Information provided in response to this document, including personal information, may be subject to publication or disclosure in accordance with the access to information regimes (these are primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 1998 (DPA) and the Environmental Information Regulations. If you want other information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the Department. The Department will process your personal data in accordance with the DPA and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

Help with queries

Questions about the policy issues raised in the document can be addressed to:

Department of Trade and Industry
Response Centre
1 Victoria Street
London SW1H 0ET
Tel: 020 7215 5000
Email: **nuclearpolicyframework@dti.gsi.gov.uk**

The Policy Framework for New Nuclear Build

The Government recognises the importance of public involvement in the land-use planning system. In the context of nuclear power stations, planning inquiries will be an important part of this public involvement.

However, in the past, where the planning inquiry has included discussions on strategic national and regulatory issues, as well as project specific and local issues, it has led to an inefficient system, creating expense and uncertainty for all participants in the system.

For nuclear projects, the Government considers that action should be taken to address some of the "generic" nuclear issues before specific nuclear proposals are considered through the planning system. The figure below sets out a framework for addressing the important issues that need to be considered before any new nuclear build can take place:

FIGURE A1

The Government sets the strategic context for new nuclear build	Regulators assure safety, security and radiological impacts of design proposals	Planning process considers suitability of specific proposal and mitigation of potential negative local impacts
Setting the Strategic Context for New Nuclear Build	Consultation on a policy framework, including a "Statement of Need" for the planning system on nuclear power leading to a national policy statement through a White Paper	
	Justification (under EURATOM Treaty) of a new "nuclear practice" to provide a balance of the benefits of the new practice against the potential health detriments	
	Strategic Siting Assessment to set out criteria for deciding on potential sites (and indicate how potential sites meet these criteria) where the Government would accept new nuclear build	
Roles and Responsibilities of the Regulators	Health and Safety Executive ensures safety of a specific power station design (with a reference to pre-licensing)	
	Office for Civil Nuclear Security ensures security of a specific power station design	
	Environment Agency / Scottish Environment Protection Agency ensures radiological and other environmental impacts of a specific power station design are managed	
Planning Inquiry to focus on suitability of proposal and mitigation of potential negative impacts	Local issues, e.g. visual impact, environmental impacts	
	Other relevant issues as inquiry inspector considers necessary	
	Final decision to grant permission taken by Secretary of State for Trade and Industry/Scottish Ministers	

Setting the Strategic Context for New Nuclear Build

Setting a Statement of Need for nuclear power in government policy

BOX A2

The Government proposes that the most appropriate process for discussion of whether there is a need for nuclear power is at a national level. This strategic position would be set out, at a national level, in the proposed policy framework, which includes a "Statement of Need" and will be formalised in a White Paper. Planning inquiries should not focus on whether there is a need for nuclear power.

The UK planning system is plan-led, meaning that there is a hierarchy of plans at national, regional and local levels that form the backdrop for any decision to grant planning permission[1]. Planning applications must be determined by the relevant authority in accordance with the development plans unless external material considerations dictate otherwise. Planning permission for new nuclear power stations would be decided by the Secretary of State for Trade and Industry in England and Wales, and in Scotland by Scottish Ministers, under section 36 of the Electricity Act 1989, as the stations would invariably have a capacity of >50MW.

The Government can introduce such material considerations, although it is ultimately for the courts to rule on what constitutes a material consideration. They have held that government statements of planning policy, as well as draft policies and plans, can be material considerations, which must be taken into account.

How will the Government introduce a Statement of Need for nuclear power?

Through the Energy Review, the Government has carefully considered the relevant issues to new nuclear power:

- economics of nuclear power;
- environmental and climate change issues;
- security of energy supply issues; and
- safety, security and radiological issues, including waste, for nuclear.

Further details are available on the Energy Review website: http://www.dti.gov.uk/energy/review/

The Government has gathered and assessed considerable amounts of evidence on these issues and the potential role that nuclear could play in helping the UK meet its energy policy goals. As a low carbon form of energy nuclear can help reduce our emissions, and in increasing the diversity of our energy supplies it can help to increase the reliability of our energy supply.

1 More information on the "plan-led" system in the UK is available on the Department for Communities and Local Government website: www.communities.gov.uk/index.asp?id=1143104

Taking all these issues into account, the Government has concluded that nuclear has a role to play in the future UK generating mix alongside other low carbon generating options.

Proposed Statement of Need

BOX A3

The Government believes that nuclear has to play a role in the future UK generating mix because of its contribution to increased diversity of energy supplies and its role as a source of low carbon generation. The Government believes that the evidence gathered during the Energy Review and the associated public consultation supports such a view.

What impact should the Statement of Need have on the Planning Inquiry?

Under this framework, the Government would assess planning applications on their merits, taking into account the policy framework set out above. We would welcome views on this approach. It is important to note that any new nuclear power stations would be proposed, constructed and operated by the private sector.

The policy framework, including a Statement of Need, and formalised in a White Paper, would form a material consideration in future nuclear power station planning inquiries. The expectation is that planning inquiries should not consider whether there is a need for nuclear power. Any planning inquiry should then proceed on the basis that there has been public consultation on the relevant strategic issues and the outcome has been formalised in the White Paper. Planning inspectors would therefore have the ability to decide not to allow discussions of these issues at the inquiry, as they would have already taken place elsewhere.

An inspector would still be able to open up such issues if they felt that there were specific aspects of these issues that had not been considered, but the presumption would be that there should not be detailed oral evidence on these issues presented to the inquiry.

Justification

One of the internationally accepted principles of radiological protection is that the benefits of an activity giving rise to ionising radiation must outweigh any adverse health consequences.

BOX A4

The economic, social and other benefits of a nuclear practice must be balanced against the economic, social and other detriments. The Government proposes that the appropriate process for such a strategic consideration is through the Justification process, as set out in the *Justification of Practices Involving Ionising Radiation Regulations*, SI 2004/1769.

What is Justification[2]?

European Union Member States are required under the Basic Safety Standards Directive to ensure that all new classes or type of practice resulting in exposure to ionising radiation are justified in advance of being first adopted or first approved by their economic, social or other benefits in relation to the health detriment they may cause.

Existing classes or types of practice may be reviewed whenever new and important evidence about their efficacy or consequences is acquired.

In the UK the Secretary of State for Trade and Industry is the "Justifying Authority" for civil nuclear power.

How would the Justification process work?

It is for the Justifying Authority to decide whether a practice belongs to a new class or type of practice or to review an existing practice.

If Justification is required, the Government will set up a Justification Liaison Group, with representatives from Department of Trade and Industry, Department for Environment, Food and Rural Affairs, Department of Health, the Regulators and the Devolved Administrations, to support the Justifying Authority in making its decision.

The Government will conduct wide public consultation, alongside engagement with the following statutory consultees:

- Health and Safety Executive;
- Food Standards Agency;
- Health Protection Agency;
- Environment Agency/Scottish Environmental Protection Agency, and
- other government Departments

Once the views of the public and the statutory consultees have been assessed by the Justification Liaison Group, the Justifying Authority will reflect on their recommendations and reach a decision.

The decision to justify a particular class or type of practice would then be formalised through secondary legislation (a Statutory Instrument).

Devolution

Since energy policy is a reserved matter, the responsibility for reaching a Justification decision would remain with the Secretary of State for Trade and Industry. Therefore any Justification decision would be UK-wide. There is a Concordat[3] between the Devolved Administrations and the Government, which sets out the working relationships in a way that respects the devolution settlements.

2 Justification was first recommended by the International Commission on Radiation Protection (ICRP) in 1977. The UK legislation on this flows from the Euratom Basic Safety Standards Directive 96/29, which was implemented in the UK under the Justification of Practices Involving Ionising Radiation Regulations 2004, SI 2004/1769 (The 2004 Regulations).

3 Concordat on the implementation of the Justification of Practices Involving Ionising Radiation Regulations 2004.

When will the Government undertake Justification?

The first step will be for the Justifying Authority to work with industry, relevant government Departments and the nuclear regulators to decide how best to assess candidate designs for new build likely to be put forward by developers. The Government will be working with interested parties during 2006/07 to make an assessment of the potential candidate designs that developers might propose.

What impact should Justification have on the Planning Inquiry?

The Justification process is an initial regulatory step, which applies to all new classes or type of nuclear practice Justification is not about approving a particular design of reactor on safety, security and other grounds, rather it is a higher level assessment of these issues, to confirm whether the benefits outweigh the potential detriments.

The government guidance emphasises that Justification decisions should take into account the whole nuclear life-cycle and therefore this process will also consider the decommissioning and waste management processes.

The expectation is that planning inquiries should not consider the general high level questions of the health and safety aspects of nuclear power, for example *"is nuclear power safe?"*. The planning inquiry should proceed on the assumption that the relevant evidence on these topics has been considered as part of the Justification decision by the Secretary of State.

An inspector would still be able to open up such issues if they felt that there were specific aspects of these issues that had not been considered, but the presumption would be that there should not be detailed oral evidence on these issues presented to the inquiry.

If new evidence comes to the fore on an existing Justification decision, then the decision may have to be revisited and reassessed by the Secretary of State.

The strategic siting of new nuclear build

BOX A5

A Government-led strategic assessment, involving public consultation, should determine the high level environmental impacts of new nuclear build. The assessment should also establish the criteria for identifying the most suitable sites for nuclear power stations, and indicate how potential sites meet these criteria. As the public will have been fully engaged at a strategic level already, the same considerations should not then be re-assessed at a later public inquiry which is site specific.

As part of setting the strategic context for new build, the Government will be undertaking a further assessment of the suitability of sites for new nuclear build. This assessment will involve a full assessment of the strategic and high-level environmental impacts of new nuclear build and will identify the criteria for locations where the Government would support proposals for new nuclear power stations. It will also indicate how potential sites meet these criteria. Industry has indicated that the most viable sites for new build are likely to be adjacent to existing nuclear generating plant, although there might be other attractive sites, for example other nuclear installations and sites with retiring fossil fuel generating stations.

The Government will begin this strategic siting assessment in early 2007. The process will involve public consultation.

What impact should the strategic siting assessment have on the Inquiry?

The Government considers that it should undertake a thorough assessment to determine the criteria by which suitable sites for nuclear power stations can be identified and in turn the most suitable specific locations. In doing so its consideration will include evaluation of the technical characteristics and the potential high-level environmental impacts of stations and whether these can be effectively mitigated.

The expectation is that following a strategic siting assessment on which the public has been engaged, planning inquiries should not re-assess the question of whether there are alternative sites for a new nuclear plant, and whether the proposed site is a viable site. Instead the focus should be on the benefits of the development and whether the potential local impacts can be sufficiently mitigated.

An inspector would still be able to explore issues covered by the strategic sites assessment if they felt that there were specific aspects of these issues that had not been considered, but it would be expected that there should not be detailed oral evidence on these issues presented to the inquiry.

The roles and responsibilities of the regulators in new nuclear build

A mature system of regulation exists for nuclear power stations in the UK. The regulators are responsible for ensuring that industry sensibly manages the risks associated with:

- health and safety;
- security;
- non-proliferation; and
- radiological discharges to the environment.

Although these issues may be relevant to whether a proposed new nuclear power station should be built, the Government proposes that the inspector at any planning inquiry should act on the assumption that the regulators will properly discharge their separate duties in these areas. The planning inspector should not expect detailed oral evidence on these issues to be heard at the inquiry.

There are discrete processes available for considering these regulatory issues and the presumption within the planning system generally is that controls should not be imposed which duplicate controls which exist elsewhere.

Health and Safety Executive

In the UK, there is a comprehensive and well-tested framework of legislation governing the health and safety aspects of the nuclear industry. The framework of legislation is backed up by assessment, inspection and enforcement methodologies carried out by the Nuclear Installations Inspectorate (NII), as part of the Health and Safety Executive (HSE), focussed on the licensing of nuclear sites. The requirement for an operator to hold a nuclear site licence granted by the HSE/NII is set out in the Nuclear Installations Act 1965.

As well as compliance with their nuclear site licence, operators of nuclear plants in the UK have to comply with the Health and Safety at Work Act 1974. This places a fundamental duty on employers to ensure, so far as is reasonably practicable, the health, safety and welfare of all their employees. It also imposes a duty to ensure, so far as is reasonably practicable, that persons not in their employment, including the public, are not exposed to risks to their health and safety as a result of the activities undertaken. Risks must be reduced to a level which is as low as reasonably practicable.

Any new nuclear power stations would require a nuclear site licence from the HSE/NII before construction could begin. The HSE/NII would also, as it does with the existing nuclear power stations, undertake routine monitoring and assessments of licensees' comprehensive Periodic Safety Reviews at least every ten years to ensure that the safety case for continued operation of the plant remains acceptable.

The HSE/NII has set out its strategy for ensuring any expanded nuclear industry sensibly manages risks in more detail in the expert report it provided to the Energy Review[4].

In preparing their expert report, as mentioned above, the HSE/NII outlined an enhancement to their regulatory strategy. The introduction of a multi-stage design authorisation process will allow the HSE/NII to make an assessment of the safety case of candidate designs for new build in advance of their site-specific assessments as part of the site licensing procedure. It is anticipated that the HSE/NII would process any applications and issue design authorisations before any planning inquiry for a new power station. More information on the recommendations of the HSE/NII report are available online[5].

This enhancement will not dilute the scrutiny of the regulator, but will introduce more clarity and transparency for both the public and industry throughout the process, including the opportunity for the public to comment. The Government recommends that the HSE/NII undertake work needed to implement such a system.

4 *The Health and Safety Risks and Regulatory Strategy related to Energy Developments; An expert report by the Health and Safety Executive contributing to the Government's Energy Review 2006*
5 http://www.hse.gov.uk/consult/condocs/energyreview.htm

Office for Civil Nuclear Security

Similarly, a legal framework is in place for security regulation. Arrangements are in place including the issue of technical guidance, regular inspections and security exercises to assure the security of all nuclear installations.

The Office for Civil Nuclear Security (OCNS) is both an autonomous regulator and security organisation acting on behalf of the Secretary of State for Trade and Industry. As the security regulator, it is responsible for exercising oversight over the conditions set to ensure the security of nuclear material, nuclear licensed sites, sensitive nuclear information and those working in the industry. Their regulatory strategy is underpinned in legislation:

- the Nuclear Industries Security Regulations 2003 make provision for the protection of nuclear material, both on sites and in transit, against the risks of theft and sabotage, and for the protection of sensitive nuclear information, such as site security arrangements; and
- the Uranium Enrichment Technology (Prohibition on Disclosure) Regulations 2004 make it an offence to make an unauthorised disclosure of uranium enrichment technology.

The regulatory framework requires all nuclear site licence holders (as issued by the HSE//NII) to have an OCNS-approved site security plan setting out how the nuclear and other radioactive material and sensitive nuclear information is made secure. The security requirements and procedures specified by OCNS in its guidance are confidential but they take fully into account the UK's obligations and commitments as well as the recommendations on the physical protection of nuclear material and nuclear facilities issued by the International Atomic Energy Association (IAEA).

As part of its duties, OCNS is required to make an annual report to the Secretary of State for Trade and Industry on its activities to ensure the security of the UK's nuclear installations. The latest report is available from the Department of Trade and Industry website[6].

UK Nuclear Safeguards Office

The IAEA operates an international mechanism, Safeguards, to detect and prevent diversion of nuclear material from peaceful use. This non-proliferation mechanism is underpinned by the international Treaty on the Non-Proliferation of Nuclear Weapons. The UK, as a nuclear weapons state, has a voluntary agreement with the IAEA and is a signatory of the EURATOM treaty, both of which cover all civil nuclear installations. Our obligations under this agreement are applied by the UK Safeguards Office.

Implementation of these safeguards agreements has focused on nuclear materials accountancy measures: each country provides the IAEA with declarations of its nuclear material (i.e. how much material there is and where it is, what are called nuclear materials accountancy reports), and information on relevant aspects of the design of the nuclear facilities concerned.

6 *"The State of Security in the Civil Nuclear Industry and The Effectiveness of Security Regulation, April 2004 to March 2005"*, www.dti.gov.uk/files/file23299.pdf

The IAEA's activities are designed to verify that nuclear material is present as declared and that relevant aspects of facility design are as declared. These activities involve regular routine inspections at nuclear facilities to confirm that the nuclear materials accountancy reports and supporting records at the facility are consistent with the information declared to the IAEA. They also perform checks on the material itself, either by means of direct measurement/sampling or by so-called containment and surveillance measures (e.g. sealing containers or stores of material, or video surveillance of plant areas) to confirm that previously measured material remains unchanged.

Any new build of nuclear reactors would be covered by these agreements. The proliferation risks from an increase in the number of modern reactors in the UK are small; all of the plants that industry have highlighted as potential candidate designs for new build in the UK can be considered as low-proliferation risk. The UK is working with the US, France, Russia, Germany and other states, as well as the IAEA, to establish international assurance of supply for nuclear fuel which will further the aim of persuading countries not to invest in enrichment and reprocessing plants, which have a greater proliferation risk.

Further information on Safeguards can be found on the IAEA website[7].

Environment Agency/Scottish Environment Protection Agency

The Environment Agency (EA) (and in Scotland, the Scottish Environment Protection Agency (SEPA)) is responsible for the regulation of a number of environmental issues:

- radioactive discharges (under the Radioactive Substances Act 1993)
- abstraction and discharge of water for cooling (under the Water Resources Act 1991)
- emissions from emergency plant, e.g. diesel generators (under the Pollution Prevent and Control Regulations 2000)
- radioactive waste licensing (under the Environmental Protection Act 1990).

The EA/SEPA oversees all nuclear installations and how radioactive waste is disposed by granting site authorisations to the operators who run them. Any operators of new nuclear power stations would have to secure an authorisation from the EA/SEPA before being allowed to bring nuclear material onto the site.

These authorisations set out limits and conditions on the amount of radioactive waste materials and the way operators dispose of their waste. The authorisations cover all radioactive waste disposals including discharges to air and water, and transfers of wastes for incineration or disposal to land. The EA/SEPA also operates an ongoing system of monitoring to ensure operators are not exceeding their limits and are releasing as little radioactive waste as possible into the environment. More information on their strategy for minimising the radiological impact of UK nuclear installations is set out in a report prepared for the Energy Review[8] by the EA.

7 http://www.iaea.org/worldatom/Programmes/Safeguards/
8 http://publications.environment-agency.gov.uk/

In preparing their report, the EA has considered how they can work with the HSE//NII in their proposed design certification process to minimise uncertainties for stakeholders during the process of securing a discharge authorisation under the Radioactive Substances Act, without compromising their high levels of scrutiny in this area. The EA are proposing to issue a preliminary statement on the "authorisability" of a candidate design for a nuclear power station alongside the HSE/NII design certification. This will give a strong indication to the developer that the radiological effects of a design should not prevent it being acceptable in the UK. The Government recommends that the EA undertake work to explore the implementation of this strategy.

The Role of Planning Inquiries in New Nuclear Build

The Government recognises the importance of public involvement in the land-use planning system. In the context of nuclear power stations, a planning inquiry will be an important part of this public involvement.

However, in the past, where the planning inquiry has been the focus of all discussions on proposals for new nuclear plant (covering strategic national, regulatory and local issues), it has led to an inefficient system, creating expense and uncertainty for all participants in the system.

For nuclear projects, the Government considers that the planning process (under s.36 of the Electricity Act 1989) should take place in the context of this framework, where the strategic and regulatory issues are addressed in advance of planning inquiries, as set out above. The planning inquiry should focus on the relationship between the proposal and the local plans, and the local environmental impacts. It should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised. The Government will reflect this policy in the setting of all terms of reference for planning inquiries.

The expectation is that planning inquires should focus on the relationship between the proposal and the local plans, and the local environmental impacts, taking into account the other "national" or strategic material considerations. Of course, the inspector will retain the right to explore any issues, e.g. the safety features of a design, that they consider to be relevant to the decision on whether to grant planning permission, but they should not expect detailed oral evidence on these issues to be heard at the inquiry. The inquiry should focus on the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.

Although the planning inquiry plays an important role in providing a forum to discuss unresolved issues, it is preferable for all parties to reach common ground where possible. For this reason, the Government proposes to introduce new inquiry rules under the Electricity Act, that will affect all large generating stations, to support the policy framework outlined above with an increased focus on front-loading the system and the use of pre-inquiry meetings to reach positions of common ground in advance of the inquiry.

Supporting information for proposed changes to the regulatory framework

The information below provides background for the proposed changes to the regulatory framework on which the Government is seeking views. Further information is available at http://www.dti.gov.uk/energy/review/

Nuclear is economic in a range of likely gas and carbon price scenarios

The Government believes that under likely scenarios for gas and carbon prices, new nuclear power stations would yield economic benefits in terms of carbon reductions and security of supply. Therefore, the Government believes that nuclear has a role to play in the future UK generating mix, alongside other low-carbon generating technologies. In reaching this assessment, we have examined the following aspects of nuclear power:

- costs
- environmental benefits
- security of supply benefits
- overall economics or "welfare balance"

A number of nuclear cost/gas price/carbon price scenarios have been considered in the economic appraisal of nuclear new build

The economics of new nuclear build depend on expectations about future gas and carbon prices, as well as expected costs of building, operating, decommissioning and dealing with the waste of a new nuclear plant. The cost benefit analysis for new nuclear build has considered a range of plausible scenarios for these variables.

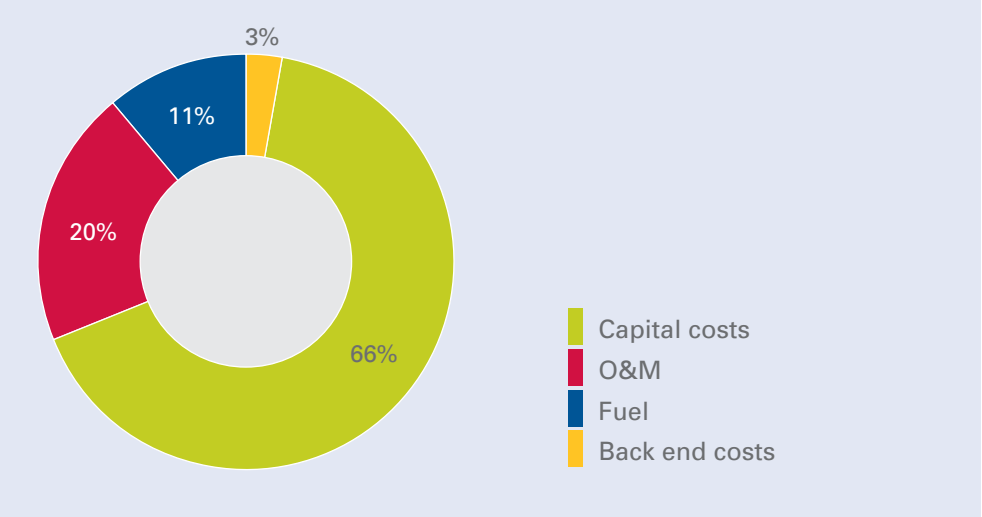
The central case cost of new nuclear power generation is assumed to be around £38/MWh. A high case nuclear cost of £44/MWh is also considered, together with a low case cost of £30/MWh.

The main cost drivers are construction and financing costs, giving an assumed capital cost of £25/MWh in the central case; this is significantly higher than the capital cost for the project currently under implementation to add a new nuclear plant in Finland.

Other categories of cost are small in comparison (see chart A1). In particular, fuel costs are around £4/MWh, representing only around 11% of total cost[9]. In this respect, it is important to note that the doubling of uranium prices since 2000 has had only a minor impact on final fuel costs and overall nuclear generation costs[10].

9 Source: DTI analysis 2006
10 IAEA/OECD "Red Book" 2005

CHART A1: NUCLEAR COSTS BY STAGE



Source: DTI Analysis, 2006

Back end costs (decommissioning and waste recycling), whilst potentially of a large order of magnitude far into the future, need only a relatively small annual contribution (equivalent to around £1/MWh) to a financial reserve which grows over time to the required amount.

The central gas price scenario models a world where the current market situation prevails, and the gas price remains linked to the oil price. Whereas the gas price has been around 20 pence/therm on average over the last decade, the average price in 2005 was 42 pence/therm.

Going forward the central gas price remains high by historical standards, based on an assumed oil price of $40/bbl. The high gas price scenario models a world where the oil price remains around $70/bbl. The low gas price scenario models a world where there is increased competition in the gas market, resulting in decoupling of the gas price from the oil price, and a falling of the gas price towards marginal cost.

Regarding carbon prices, the range covered in the analysis models worlds where: there is no commitment to carbon reduction (then the carbon price is €0/tonne); there is some commitment, but carbon reduction targets are such that abatement costs remain low (€15 (£10)/tonne of CO_2); there is ongoing commitment to carbon reduction, resulting in a carbon price in line with the first quarter 2006 UK market price (€25 (£17)/tonne of CO_2); there is ongoing commitment to carbon reduction, with tightening targets resulting in increased abatement costs (€36 (£25)/tonne of CO_2).

Nuclear generation has a small cost penalty relative to gas-fired generation in the central case.

Gas fired generation has a narrow cost advantage over new nuclear generation in the central gas price scenario, and this advantage becomes greater as the gas price falls and/or the nuclear cost increases. Nuclear generation has a cost advantage in a high gas price scenario and in a low nuclear cost scenario.

Carbon emissions reductions are significant relative to gas fired plant

The annual carbon emissions reduction from investing in a GW of nuclear plant is approximately 2.5 million tonnes of CO_2 (700,000 tonnes of carbon)/GW compared to investment in gas fired plant. For illustrative purposes for this cost benefit analysis, a programme to add 6GW of new nuclear capacity would reduce annual emissions by around 15 million tonnes of CO_2 (4 million tonnes of carbon). Valuing emissions savings at a CO_2 price of €36 [£25]/tonne gives a present value benefit of around £1.4 billion/GW over forty years from nuclear new build.

It is important to note that the emissions reduction figure above nets out lifecycle emissions associated with construction of nuclear plants, and with mining, transportation and processing of uranium. Estimates of lifecycle emissions for different power generation technologies are summarised in the following table published by the OECD:

Technology (2005-2010)	GC/kWh*	Equivalent to GCO_2/kWh**
Lignite	228	836
Coal	206	755
Natural Gas	105	385
Biomass	8-17	29-62
Wind	3-10	11-37
Nuclear	3-6	11-22

Table A1: Total Lifetime Releases From Selected Technologies

**Grams of carbon per kilowatt hour of electricity produced*
*** Grams of carbon dioxide per kilowatt hour of electricity produced*
Source: OECD Nuclear Energy Agency

Some critics of nuclear energy have questioned its credentials as a net producer of low carbon energy. In particular it has been claimed that, as ore grades deteriorate as uranium is used, the energy consumed by mining and milling will exceed the energy produced by the nuclear power plants and result in similar overall carbon dioxide releases to fossil generation.

It is true that lower grade ores will require more energy to make fuel for nuclear power stations, which could increase the lifecycle carbon emissions from nuclear power. However, as highlighted by the Sustainable Development Commission it is not expected that high-grade resources will be depleted in the foreseeable future[11]. This view is endorsed by the IAEA; none of the planned new mining projects are of significantly lower grade ores than that currently mined[12]. As such, we can have confidence that the estimates of the lifecycle emissions from nuclear will remain comparable with wind power, a view endorsed by the Sustainable Development Commission[13].

11 Sustainable Development Commission – *"Paper 8 Uranium Resource Availability"*. *www.sd-commission.org.uk/pages/060306.html*
12 Information from IAEA member states submitted to IAEA /OECD for *"Uranium 2005: Resources, Production and Demand"*, aka "Red Book".
13 Sustainable Development Commission – *"Paper 2 Reducing CO_2 Emissions – Nuclear and the Alternatives"*.

Security of supply benefits relative to gas fired generation relate to the risk of gas supply interruption.

Investment in new nuclear capacity would reduce the level of total gas consumption and gas imports in 2025. A programme to add 6GW of new nuclear capacity by 2025 would reduce total forecast gas consumption in 2025 by around 7%.

Nuclear can also be an important source of baseload generating capacity.

In a world where gas fired plant is added to the power system rather than nuclear plant, this increases vulnerability in the event of a gas supply interruption. Given this vulnerability, the economic option would be to back up gas fired plants with oil distillate switching capability. In the event of a gas supply interruption, gas fired plants would then be able to continue operating by burning oil distillate rather than gas.

If nuclear plant is added rather than gas fired plant, there is no longer the need to maintain back up capability. One benefit of nuclear generation can then be seen as the avoided cost of this capability, estimated to be of the order £100 million/GW. In a more unstable world subject to the possibility of repeated/prolonged fuel supply interruptions, new nuclear generation can be viewed as a hedge either against high gas prices, or high costs of ongoing electricity generation using oil.

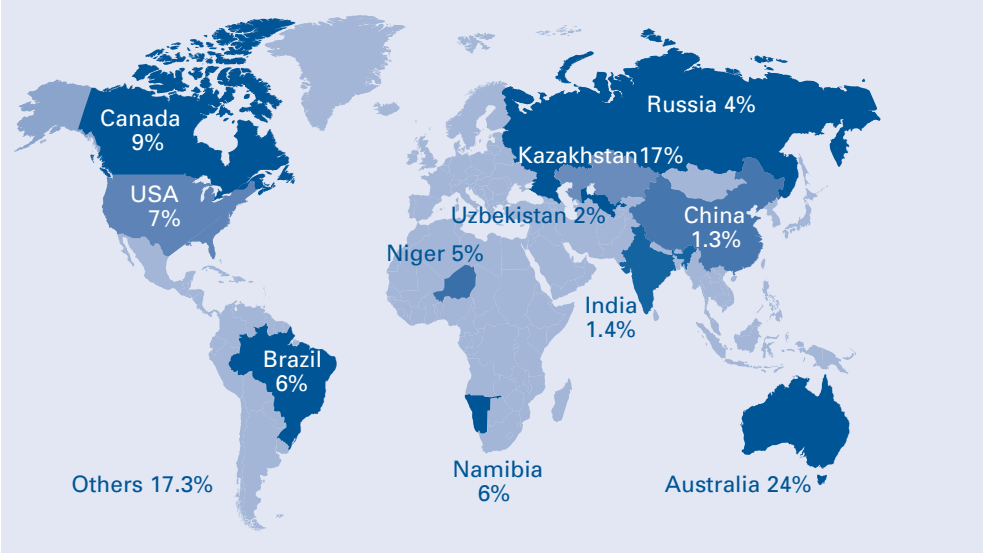
There is of course the possibility that nuclear fuel supply might be interrupted; realising the potential benefits of new nuclear build would naturally be dependent on the availability of nuclear fuel. A number of assessments of the availability of fuel were considered as part of the Energy Review process. The range of assessments of future prospects for uranium supplies reflects the difficulty in making exact predictions, in exactly the same way as predictions of future oil and gas reserves cannot be guaranteed.

However, every two years, the IAEA and OECD (NEA) undertakes a comprehensive assessment of the availability of uranium, taking into account expected production and demand levels. Their most recent report[14] estimates the identified amount of conventional uranium resources that can be mined for less than USD 130/kg, just above the current spot price, to be about 4.7 million tonnes. Based on the 2004 nuclear electricity generation rate this amount is sufficient for 85 years.

As chart A2 shows, deposits of uranium ore are distributed across a number of countries, including those on whom we are not dependent for fossil fuels; therefore new nuclear build should help the UK become less reliant on a limited number of players for energy supplies.

14 IAEA / OECD Red Book 2005.

CHART A2: URANIUM SOURCES



Source: IAEA/OECD (NEA) Red Book 2005

It is difficult to make exact predictions on how long uranium deposits will last in any given country because it is dependent on a number of variables:

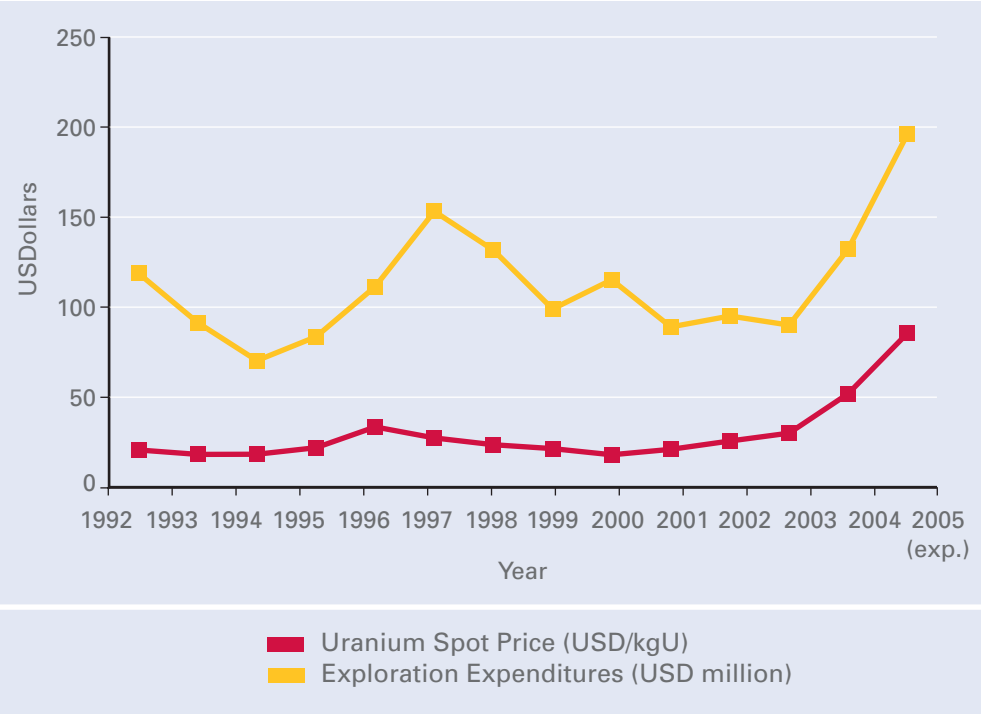
- new mines coming on stream;
- price of uranium ore – the price effects the mining market and may make mining of certain deposits more viable;
- new nuclear reactor technology may use less uranium thereby extending the lifetime of available uranium deposits;
- more nuclear reactors may be built thereby increasing the demand on available uranium deposits;
- increased use of reprocessing to recycle used fuel and create MOX (Mixed Oxide) fuel (a mix of uranium and plutonium).

Using IAEA figures it is possible to make a rough, high-level estimate that reserves in the world's major exporters of uranium, Australia and Canada, based on current estimated resource and production levels will last another 150 years and 45 years respectively[15].

Whilst the demand for uranium has increased in recent years, resulting in higher prices for uranium ore, future increases, even with further increasing global demand, are expected by the IAEA/OECD to be modest. Prices are expected to remain substantially below the historically high levels of the 1970s, but the increases we have seen are expected to encourage further exploration of uranium resources, as can be seen in the new mines expected to open across the world and the increasing exploration expenditure:

15 Source: IAEA/OECD "Red Book" 2003

CHART A3: TREND IN URANIUM EXPLORATION EXPENDITURES FOR SELECTED COUNTRIES



SOURCE: IAEA / OECD (NEA) Red Book 2005

In addition, the UK has a substantial supply of recycled uranium and enrichment tails, which could be used to supplement the supply of uranium ore from overseas. Recycled uranium would need to be treated; currently only France and Russia have the capability. With changing market conditions, it may be attractive to build such facilities in the UK. Alternatives fuels such as MOX, which uses a mix of uranium and plutonium, could further supplement uranium supplies.

The welfare balance is positive in central/high gas price, central/low nuclear cost worlds, and negative in low gas price/high nuclear cost worlds

The welfare balance associated with nuclear new build relative to a do nothing scenario where gas fired plant is added to the power system is the sum of environmental and security of supply benefits net of any nuclear cost penalties. Welfare balances under alternative scenarios are presented in the summary table below.

The table shows that, even at the high end of carbon prices, the net benefit of nuclear generation is negative at low gas prices or high nuclear costs. In a low gas price scenario, a CO_2 price of €54 (£37)/tonne is required to justify new nuclear generation. In a high nuclear cost scenario, a CO_2 price of just above €36 (£25)/tonne is required in order that the net benefit of new nuclear generation is positive.

Table A2: nuclear generation welfare balance under alternative gas price, carbon price and nuclear cost scenarios, (net present value) NPV over forty years, £ million/GW					
Carbon price (€/ tCO_2)	Low gas price	Central gas, high nuclear	Central gas price	Central gas, low nuclear	High gas price
0	-2,100	-1,400	-400	**900**	**1,400**
15	-1,500	-900	**200**	**1,400**	**2,000**
25	-1,100	-500	**600**	**1,800**	**2,400**
36	-700	0	**1,000**	**2,300**	**2,800**

The welfare balance is positive in the central gas price world for a CO_2 price above €10 (£7)/tonne, and in high gas price/low nuclear cost worlds across the range of carbon prices (including a zero carbon price). Under the central gas price and a CO_2 price of €36 (£25)/tonne, the NPV benefit over 40 years associated with a 6GW nuclear programme would be of the order £6 billion.

Nuclear generation is likely to be justified in a world where there is continued commitment to carbon emissions reduction and gas prices are at or above 37 pence/therm.

The economic case against nuclear arises if the probability of low gas prices/high nuclear costs is significantly higher than the probability attached to other scenarios, and/or the CO_2 price is significantly less than the €36 (£25)/tonne value assumed in the analysis.

In the central gas price scenario, nuclear generation is economically justified unless commitment to emissions reduction falls away, in which case the relevant carbon price may become zero. As far as some commitment remains, net benefits associated with nuclear investment are positive, largely reflecting the environmental benefits of this option.

This continues to be true as nuclear costs increase beyond the range given in the various studies of nuclear generation. In the central gas price scenario, and valuing environmental benefits at a CO_2 price of €36 (£25)/tonne, the economics of nuclear generation remain robust for a nuclear generation cost up to £43.50/MWh. This is well above the forecast cost of power generation from the Finnish nuclear project currently under construction, by a margin that far exceeds any historical cost overruns associated with nuclear projects (e.g. Sizewell B).

Economic risks associated with nuclear playing a role in the future energy mix would appear to be limited.

In summary, the economics of nuclear depend critically on assumptions made about future gas and carbon prices, and nuclear costs. On some sets of assumptions, the nuclear case is positive; in others, negative, so a judgement has to be made about the relative weight to be given to the various scenarios.

In making such a judgement, it is important to note that probabilities associated with many of the various states of the world are endogenous rather than exogenous, and depend on policy decisions. This is true of the carbon price, which will depend on whether the UK remains committed to its goal of long-term carbon reduction. To the extent that commitment *does* remain, then higher carbon price scenarios should be given more weight. It is true also for nuclear costs, where policy to improve the planning process would reduce the likelihood of a high nuclear cost scenario ensuing. Regarding gas prices, the weight to be attached to the high gas price scenario is again a policy decision. Where the Government is averse to the risk of high gas prices, other things being equal, more weight should be attached to this scenario.

Within these likely scenarios nuclear generation yields positive net economic benefits. An additional factor in support of this argument is that the likelihood of low nuclear costs would increase for a programme of new build as opposed to a one off plant addition; the analysis of the forecast UK capacity balance suggests that there would be scope for a programme.

The resource cost of taking facilitative measures for new nuclear build would be limited initially to work required for improving the planning process, and for elaborating details of waste and decommissioning arrangements. The likelihood is that commercial projects would only be forthcoming in a world where the supporting policy framework as described above is in place, in which case expected economic benefits would be positive.

ANNEX B

Overview of Modelling of the Relative Electricity Generating Costs of Different Technologies

Introduction

This paper sets out results of modelling undertaken as part of the Energy Review. The purpose of this modelling is to provide estimates of the relative cost of electricity generation technologies under different scenarios and assumptions to inform policy analysis. These estimates do not represent a government view on the relative costs of the technologies. To take account of uncertainties on the assumptions we have also undertaken sensitivities.

The modelling is based on levelised costs and is not intended to predict specific private sector investment decisions or to 'rank' different generation technologies. Energy investment decisions are taken in the UK by the private sector within a market-based energy policy framework and take into account a range of specific factors, including for example post construction financing costs and market conditions, which are not incorporated into this modelling.

The scenarios considered in the modelling include a base case; varying assumptions for gas and carbon prices; and a full range of sensitivities including discount rate, capital cost, operating and maintenance (O&M) costs, fuel prices, carbon prices, load factors and interest rate margin (for construction finance only).

Methodology

Overview

We have developed a model to assess the levelised cost of a number of technologies considered in the Energy Review. These technologies are gas- and coal-fired power plant (with and without Carbon Capture and Storage); nuclear; and onshore and offshore wind generation.

The levelised costs for the technologies are presented as a range in £/MWh. The levelised costs are calculated by summing capital (annuitised and including interest during construction), O&M and fuel costs over the life of the plant, and dividing this sum by the sum of electrical output, i.e. total lifetime costs divided by total lifetime electrical outputs.

The analysis is based on a range of assumptions and data. For each technology, assumptions have been compiled on the basis of recent studies which are referred to in the Appendix to this Annex. All of the assumptions and the resulting levelised costs are based on "first of a kind" costs (i.e. the costs incurred from building a standalone plant, ignoring cost reductions that may be achievable through economies of scale or technology learning). The model structure and assumptions used are set out in the Appendix to this Annex.

We have also modelled sensitivities on the key assumptions and data (up to 30 sensitivities, including ranges in the discount rate, capital cost, O&M costs, fuel prices[1], carbon prices, load factors and interest rate margin for construction finance). We do not estimate probabilities for the occurrence of the sensitivities. Providing probabilities would unfairly weight outcomes, and would add a spurious level of accuracy to the underlying probability distributions of the sensitivities.

Model review

As part of their financial advice to the Energy Review, Ernst & Young LLP performed a review of the structure and logical integrity of the model which was developed by the Department of Trade and Industry (DTI) to generate the relative costs set out in this Annex. This review included conducting a test programme of the model's arithmetic based on specific input scenarios to assess whether the model has been constructed in a manner consistent with its stated objectives of generating an estimated levelised cost of power and an estimated new entry price for each of the five energy technologies on the basis of the DTI's chosen assumptions and input data set out in the Appendix to this Annex.

Ernst & Young LLP reported to the DTI that in its opinion, based on the work performed on the specific instructions of and solely for the DTI, the model has been constructed appropriately, in so far as its logical integrity and arithmetic is concerned, so as to achieve materially the objectives described above under both the base case assumptions for each of the energy technologies and the specific designated sensitivities. The scope did not extend to considering the appropriateness of the assumptions and additionally Ernst & Young LLP may not have addressed issues of relevance to any other party. It accepts no responsibility or duty of care to any party other than the DTI. Any reliance placed upon the model review by any third party is entirely at such party's own risk.

Technologies modelled

The technologies that have been modelled are:

- Gas plant:
  - Combined Cycle Gas Turbine (CCGT). The analysis is based on H Frame technology which is now considered "state-of-the-art" in the UK context and is commercially available and deployed at Baglan Bay power station in Wales.
  - CCGT with Carbon Capture and Storage (CCS). CCS is an emerging technology and CCGT with CCS has not yet been deployed on a large scale. The key developmental elements of CCS relate to the CO_2 separation technologies (i.e. pre-combustion, post-combustion and oxyfuel) and the storage location and formation for storage (e.g. for enhanced oil or gas recovery, depleted gas fields and saline aquifers).

1 Fuel price assumptions and carbon costs are included as the basis for modelling a number of potential scenarios and do not represent predictions of future prices.

- Coal plant:
  - Pulverised Fuel (Advanced Super Critical, ASC) with Flue Gas Desulphurisation (FGD). This is considered the base case coal technology which is being deployed around the world.
  - Pulverised Fuel (ASC) with FGD and CCS.
  - Integrated Gasification Combined Cycle (IGCC). This technology is currently being commercialised.
  - IGCC with CCS.

- Retrofit coal plant based on Pulverised Fuel (ASC) with FGD with CCS.

- Nuclear:
  - The analysis focuses on the Light Water Reactor (LWR) design types, including Pressurised Water Reactors and Boiling Water Reactors which are based on evolutionary third generation nuclear technologies used worldwide.

- Wind:
  - Onshore wind. Modelling here is based on an 80MW wind farm.
  - Offshore wind. Modelling here is based on a 100MW wind farm.

Scenarios considered

There are a large number of potential factors that influence the generation costs of different technologies which are modelled here through sensitivity analysis of key data and assumptions. In this report we present four cases, demonstrated through seven charts. In each case we provide a short commentary to aid interpretation of the charts.

The four cases we consider are:

1. **Base Case** – central gas price (36.6p/therm[2]) and no carbon price included.

2. **Carbon Price Added**[3] – As the "Base Case" but with a carbon price of €25/t CO_2 (£17/t CO_2).

3. **Gas and Carbon Price Sensitivities** – As the "Base Case", but with low/high gas prices (low at 21p/therm and high at 53p/therm) and varying carbon prices €15/t CO_2 (£10/t CO_2) and €36/t CO2 (£25/t CO_2).

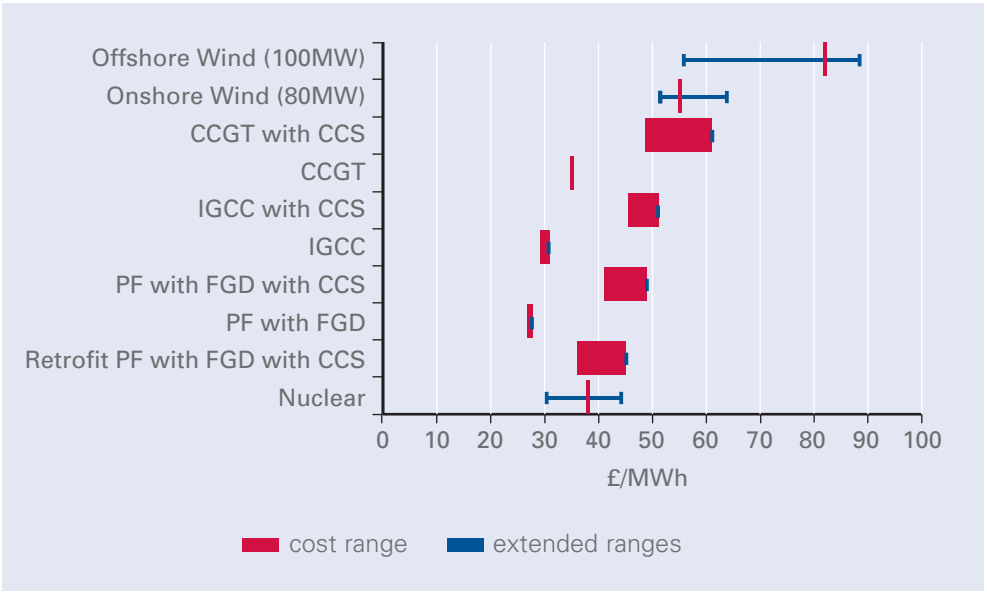
4. **Full Sensitivity Ranges** – As "Carbon Price Added" but with ranges for the discount rate, capital costs, O&M costs, fuel prices, carbon prices, load factors and interest rate margin (for construction finance).

2 Fuel price assumptions to 2020 are published in Annex C of this document.

3 Carbon costs are included as the basis for modelling a number of potential scenarios and do not represent predictions of future CO_2 prices. The range covered in the analysis models worlds where: there is some commitment to carbon reduction, but carbon reduction targets are such that abatement costs remain low (€15 (£10) / tonne of CO_2); there is ongoing commitment to carbon reduction, resulting in a carbon price in line with the first quarter 2006 UK market price (€25 (£17) / tonne of CO_2); there is ongoing commitment to carbon reduction, with tightening targets resulting in increased abatement costs (€36 (£25) / tonne of CO_2).

Results

CHART B1: BASE CASE (CENTRAL GAS PRICE AND NO CARBON PRICE INCLUDED)



Comments on Chart B1:

- In this case we plot base case costs for each technology. The red blocks represent the range of costs based on assumptions provided in Table B1 in the Appendix to this Annex and the blue lines represent extended assumptions on capital costs for wind and nuclear set out in Table B2.
- Given the sensitivity of the levelised cost to fuel prices, it is worth specifically noting that the CCGT cost is based on a 36.6p/therm gas price and the coal technologies are based on a £25/t coal price.
- The small red ranges associated with some technologies (e.g. CCGT) reflect a high degree of confidence in the cost estimates for technologies that are proven and where there is good data to draw on.
- In the case of technologies deploying CCS, the larger costs ranges in red reflect the lack of operational knowledge of these technologies, resulting in particular in large ranges in current estimates of operation and maintenance costs. The range of cost for IGCC technology without CCS is wider than PF coal technology, reflecting the uncertainty around integration and scale of the technology.
- For the wind and nuclear technologies, the range presented in blue reflects the influence of capital costs, which vary over time. In these cases, the levelised costs are particularly sensitive to these costs.

CHART B2: BASE CASE COSTS WITH CENTRAL GAS PRICE AND CARBON PRICE OF €25/tCO_2

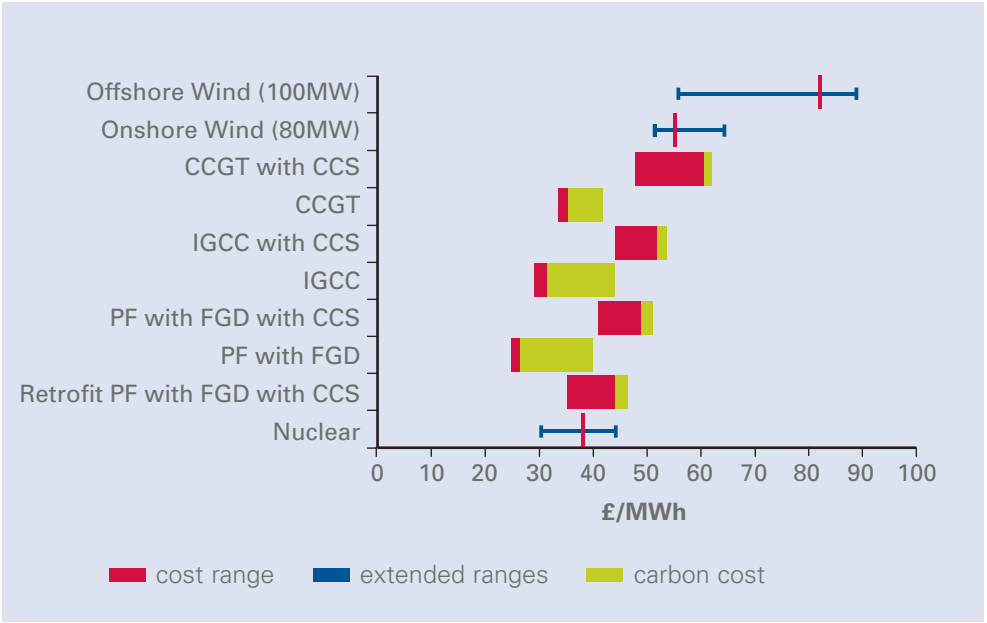


CHART B3: BASE CASE COSTS WITH CENTRAL GAS PRICE AND CARBON PRICE OF €15/tCO_2

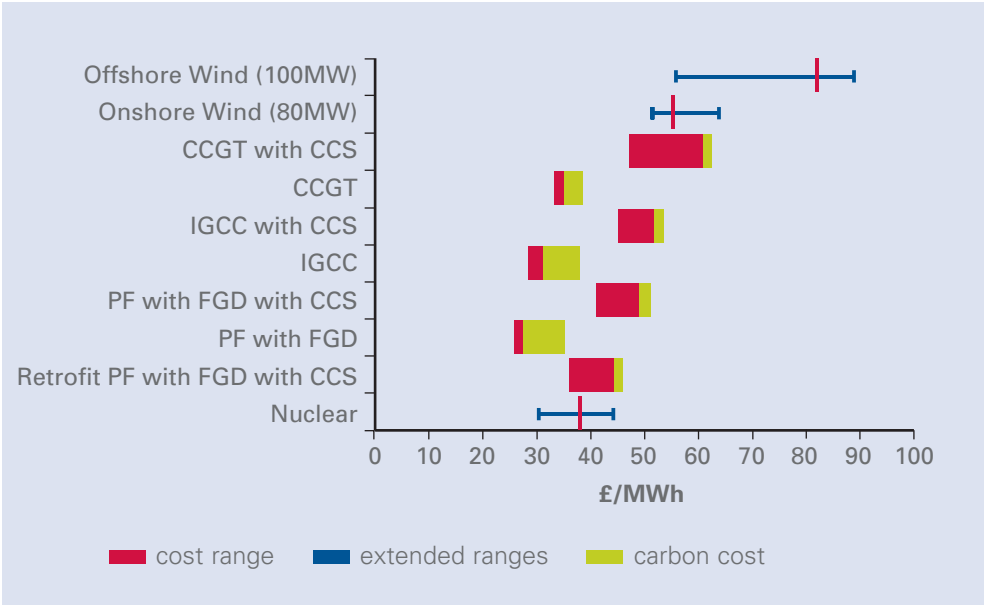
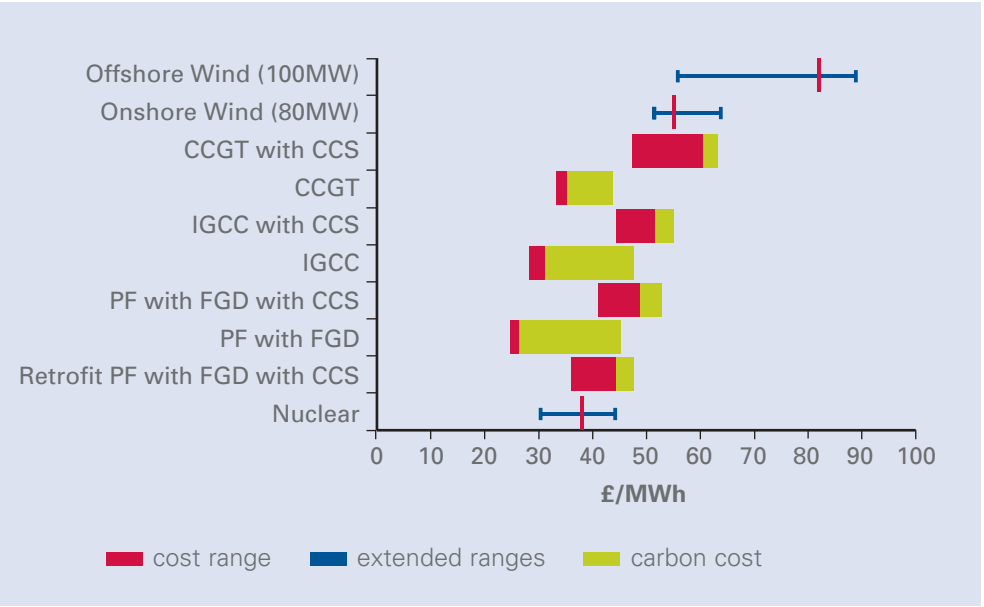


CHART B4: BASE CASE COSTS WITH CENTRAL GAS PRICE AND CARBON PRICE OF €36/tCO_2



Comments on charts B2 to B4:

- In these charts, the cost of carbon has been added to the base case costs from chart B1.
- Carbon costs are shown in green, and represent the additional cost of generation from each technology imposed by the carbon price. Thus the green bars are wider for more carbon intensive technologies.
- We take varying costs of carbon (€25/t CO_2 (£17/t CO_2); €15/t CO_2 (£10/t CO_2) and €36/t CO_2 (£25/t CO_2)). These costs are included as the basis for modelling a number of potential scenarios and do not represent predictions of future CO_2 prices.
- The carbon costs are based on the emission factor for the plant, multiplied by the market price for carbon (converted into a cost per MWh).
- The carbon emissions factors are based on DEFRA's National Atmospheric Emissions Inventory (NAEI) divided by the efficiency factor for the relevant technology.

CHART B5: BASE CASE COSTS WITH CARBON PRICE (€25/tCO_2) AND LOW GAS PRICE (21P/THERM)

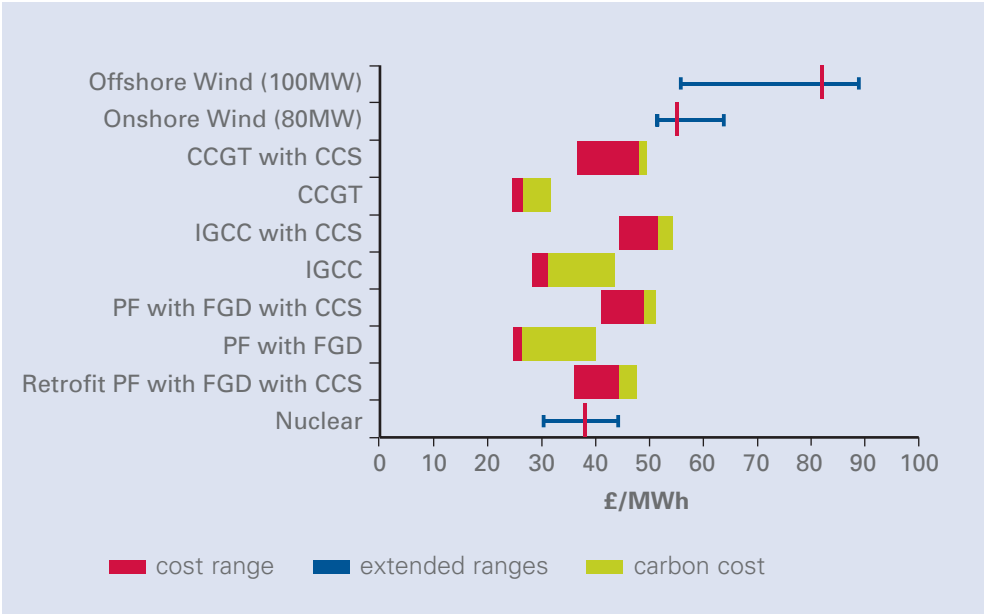
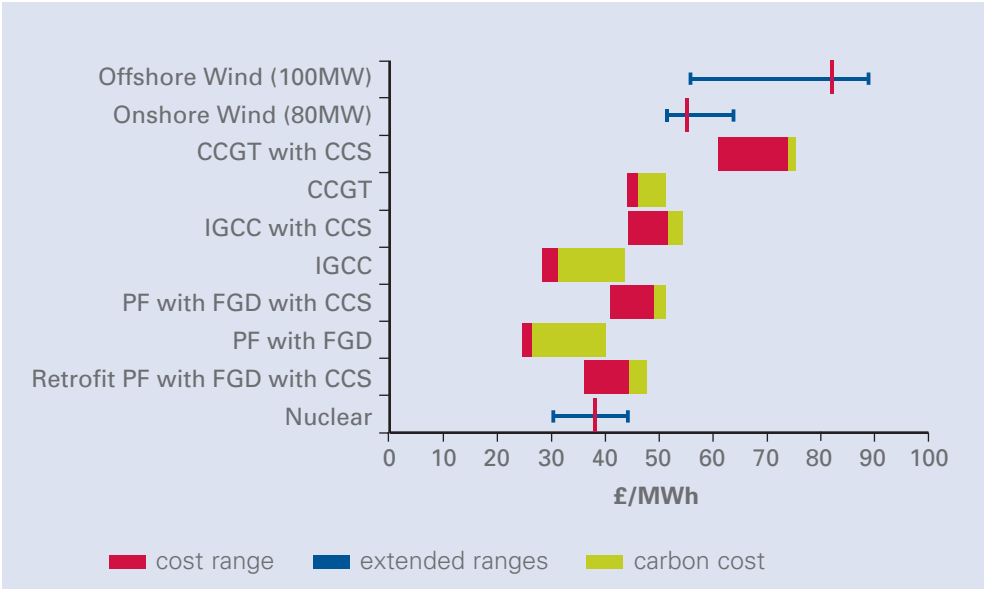


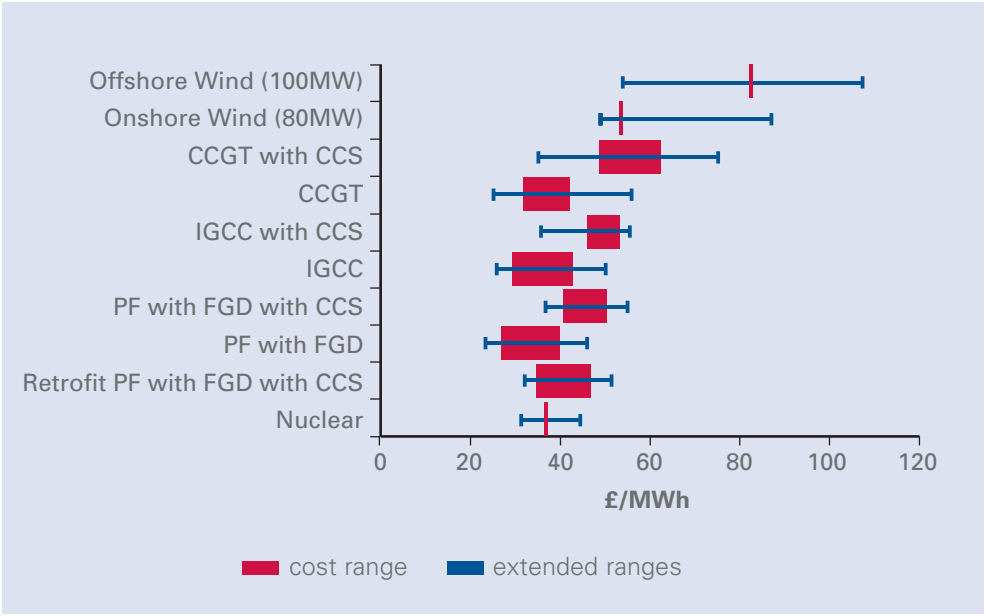
CHART B6: BASE CASE COSTS WITH CARBON PRICE (€25/tCO_2) AND HIGH GAS PRICE (53P/THERM)



Comments on charts B5 and B6:

- In these charts, the cost of gas is varied and a price of carbon of €25/t CO_2 (£17/t CO_2) is assumed. Varying the gas price results in changes to the cost of CCGT and CCGT with CCS, while the cost of all other generation technologies remain the same as in chart B2.
- Charts B5 and B6 take a low and high price for gas respectively (low is 21p/therm, and high is 53p/therm). These gas price assumptions are published in Annex C of this document.

CHART B7: FULL SENSITIVITIES (DISCOUNT RATE, CAPITAL COST, O&M COSTS, FUEL PRICES, CARBON PRICES, LOAD FACTOR AND INTEREST RATE MARGIN)



Comments on chart B7:

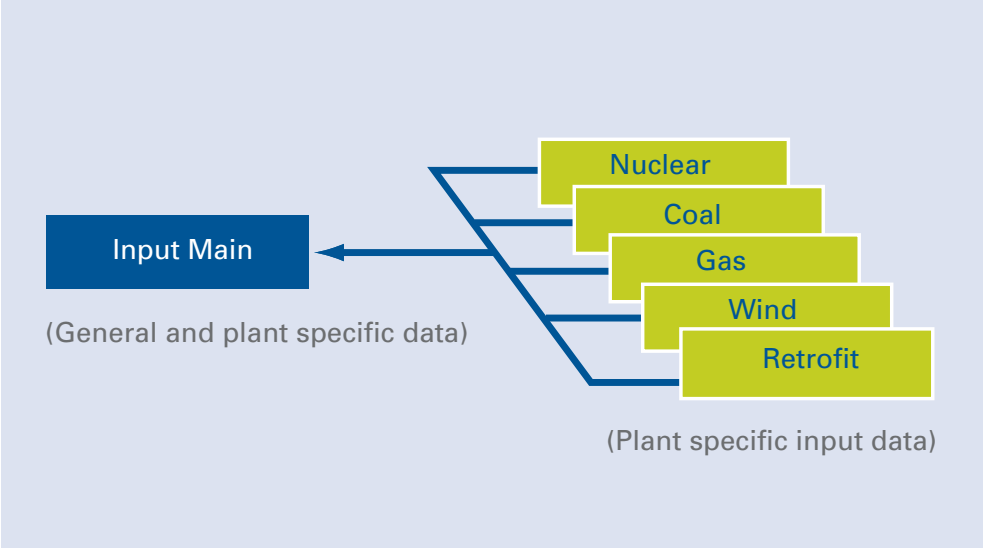
- The chart presents the full range of sensitivities that have been conducted for each technology represented by the blue lines. Section 3 of the Appendix to this Annex provides further detail on the sensitivities.
- The ranges in red include carbon costs based on a carbon price of €25/t CO_2 (£17/t CO_2). The red ranges are therefore different from the base cases presented in Chart 1.
- The blue lines around the red ranges are used to represent the outcomes from the range of sensitivities tested for each technology.
- The sensitivities examined are: discount rate, capital cost, O&M costs, fuel prices, carbon prices, load factors and interest rate margin for construction finance.
- The low end of the range reflects the low range of the sensitivities (low discount rate, low fuel prices) and the high end reflects high discount rate and high fuel prices.

APPENDIX: Overview of Modelling of the Relative Electricity Generating Costs of Different Technologies

1. Introduction

We have developed a financial model to assess the economic cost of the generating technologies (refer http://www.dti.gov.uk/energy/review). The generating technologies are gas-fired, coal-fired, nuclear, onshore wind and offshore wind generation.

INPUT DATA MODEL STRUCTURE



For each technology assumptions have been compiled on the basis of recent studies for the:

- predevelopment period;
- construction period; and
- costs associated with:
  - construction,
  - operation,
  - and the back-end costs as they apply to nuclear (specifically decommissioning and waste disposal).

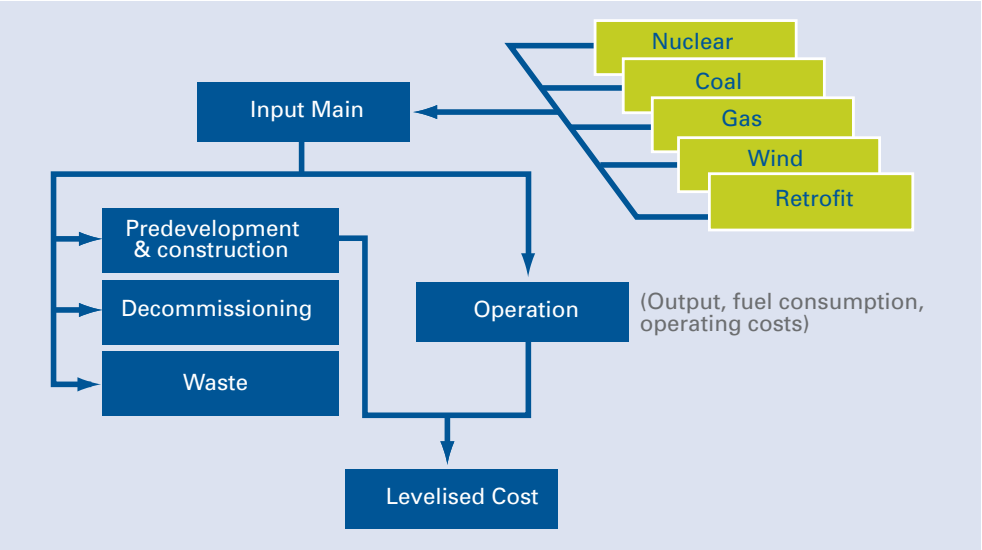
All of the assumptions are based on first of a kind costs, and therefore they do not take into account the effects of learning or the potential cost savings if more than one plant type is brought forward. The construction is assumed to be on a greenfield site aside from the retrofit coal option where the cost of the existing plant and associated infrastructure is fully depreciated, i.e. has a cost of zero. Furthermore we have modelled a range of cases for alternative values of key variables. Probabilities are not assigned to the various variables

as doing this would suggest a spurious degree of information about underlying probability distributions for the key variables.

1.1 Levelised costs

The cost of generating electricity has been calculated on a levelised cost basis expressed in £/MWh. The calculation takes the long-run average costs of a particular generating technology over its lifespan divided by the total output. Costs include the capital cost (in an annuitised form including interest during construction), the operating costs and the fuel cost. All numbers are real (in 2006 prices) and the capital cost is annuitised using a 10% discount rate.

LEVELISED COSTS



2. Modelling Assumptions

Table B1 details the assumptions used in the financial model and Section 4 details the sensitivities.

2.1 Capital, operating and plant performance assumptions

For the capital cost, operating cost and plant performance assumptions we have used Redpoint Energy[4] and industry sources for the gas and coal technologies, Oxera and Enviros[5] for the onshore wind, Climate Change Capital[6] for the offshore wind and various sources for nuclear technologies as noted in the Nuclear Cost Benefit Analysis on the Energy Review website.

These sources are a subset of the numerous market studies that have been published[7], some of which analyse all technologies whilst others have focused on specific technologies. Our aim has been to use the most representative data for a project being developed in the UK. We have not presumed to

4 Redpoint Energy (July 2006) *The Dynamics of UK Generation Investment.*
5 Enviros Consulting Limited (September 2005) *The Cost of Supplying Renewable Energy;* Oxera (January 2005) *What is the potential for commercially viable renewable generation technologies – Interim report prepared for the DTI.*
6 Climate Change Capital (February 2006) *Assessing the risks and implications of government contracts for offshore wind.*
7 A full list of studies referred to is included in Section 5 of this Appendix.

choose the best case but rather the most plausible and therefore our assumptions may appear to be conservative when compared to some studies.

2.2 Interest during construction

For all technologies, the interest during construction is added to the capital cost and annuitised for the levelised cost. Interest is assumed to be 6.26% (the London Inter Bank Offered Rate of 4.26% and a 2% margin). The amount leveraged is assumed to be 70%.

2.3 Fuel price assumptions

Fuel price assumptions for gas and coal to 2020 have been used, thereafter they have been assumed to be straight line. The fuel price assumptions are detailed in Annex C of this document.

2.4 Carbon Sequestration

Given the generic modelling of each project a simplified central assumption of £8/t CO_2 has been used for the transport and storage of CO_2. This equates to £3/MWh for a CCGT with CCS and £6/MWh for the coal-fired technologies with CCS.

2.5 Nuclear decommissioning and waste disposal

Details of the work programme and timetable to establish arrangements for dealing with the costs of decommissioning and waste from nuclear new build will be published by the time of the White Paper. The Government has not taken a position on how these arrangements should be designed. The nuclear section of chapter 5 sets out certain principles which will apply to the arrangements developed. That chapter also establishes that industry participants will need to meet the financial requirements established by the Government's decommissioning and waste frameworks even in challenging downside scenarios.

For the purposes of the cost benefit analysis, we have made some assumptions which in no way prejudice the outcome of work to determine the arrangements for dealing with the costs of decommissioning and waste from nuclear new build. The cost assumptions are detailed in Table B1 and in the Nuclear Cost Benefit Analysis[8].

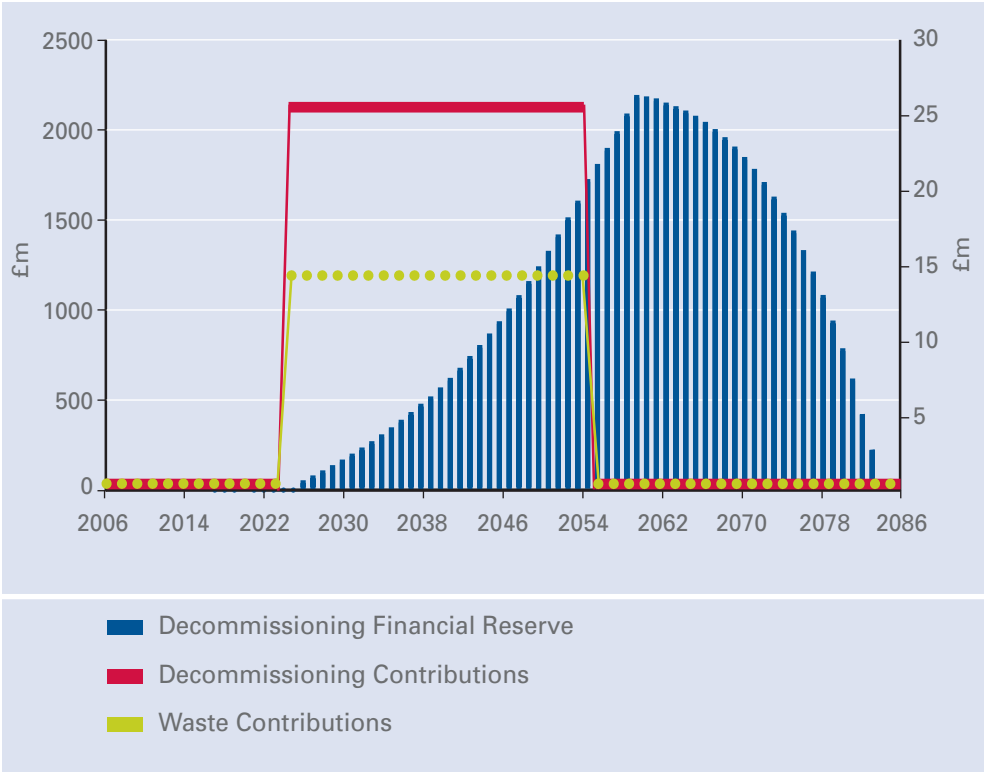
2.5.1 Decommissioning

As the entity operating the plant will be responsible for meeting the costs of decommissioning, it has been assumed that the entity operating the plant will make an annual contribution to build a financial reserve so that by the end of operation sufficient reserves are in place to meet the cost of decommissioning. The reserve is assumed to grow at 2.2%.

Decommissioning is assumed to take 25 years and begins at the end of the operating life of the plant and finishes 65 years after the start of plant life. Therefore whilst a portion of the reserve is being spent, the balance is continuing to grow at 2.2%. At the end of the 25 year decommissioning period the financial reserve has been drawndown to zero. This model is illustrative. The methodology described is illustrated in the chart below.

8 This is available at www.dti.gov.uk/energy/review

APPENDIX CHART 1: DECOMMISSIONING AND WASTE FUNDING



2.5.2 Waste management

Waste disposal assumes the same methodology as decommissioning as described in 2.5.1 above for the levelised cost calculation. For the purposes of the cost benefit analysis, we have made some assumptions which in no way prejudice the outcome of work to determine the arrangements for dealing with the costs of decommissioning and waste from nuclear new build. The financial reserve built by the operating entity to meet waste costs is assumed to be spent in the first year at the end of operations rather than over 25 years (as per decommissioning).

3. Data Assumptions

Table B1 details the key data assumptions used in the financial model.

Table B1: Assumptions underlying the levelised costs for the technologies

Technology	Capital Cost[1] £/kW	Operations & Maintenance Fixed £/kW	Operations & Maintenace Variable p/kWh	Efficiency[2] %
Gas-fired plant				
CCGT	440	7.0	0.20	58.0
CCGT with CCS – low	828	12.0	0.17	50.0
CCGT with CCS – high[3]	698	123.0	0.00	47.6
Coal-fired plant				
Retrofit PF with FGD and CCS – low	721	24.9	0.25	33.5
Retrofit PF with FGD and CCS – high[3]	721	77.9	0.46	33.5
PF with FGD – low	918	17.0	0.11	45.6
PF with FGD – high	882	31.3	0.20	44.1
PF with FGD with CCS – low	1,162	26.0	0.27	36.6
PF with FGD with CCS – high	1,625	81.3	0.50	34.8
IGCC – low	1,069	19.0	0.12	44.5
IGCC – high	1,030	50.0	0.20	48.3
IGCC with CCS – low	1,452	26.0	0.26	39.0
IGCC with CCS – high	1,715	100.0	0.40	39.9
Wind plant				
Onshore Wind (80MW)	819	44.4	0.00	100.0
Offshore Wind (100MW)	1,532	46.0	0.00	100.0
Nuclear plant				
Pressurised Water Reactor[4,5]	1,407	56.6	0.00	36.1

Real numbers in 2006 prices
1. Capital cost – includes owners costs but excludes interest during construction
2. Efficiency is noted on an LHV basis
3. O&M uplift based on Redpoint new build assumptions
4. The availability used for nuclear plant assumes 80% in the first five years
5. Decommissioning cost assumed to be £400/kW and waste cost assumed to be £173/kW

Plant Life	Load Factor	CO_2 Sequestration	CO_2 Transport and Storage	Basis for capital and O&M cost assumptions
years	%	%	p/kWh	
35	85	N/A	N/A	Industry sources
35	85	90	0.3	Industry sources
35	85	90	0.3	Foster Wheeler
30	90	90	0.6	Industry sources
30	90	90	0.6	Industry sources
50	90	N/A	N/A	Industry sources
50	90	N/A	N/A	Redpoint Energy
50	90	90	0.6	Industry sources
50	90	90	0.6	Redpoint Energy
35	90	N/A	N/A	Industry sources
35	90	N/A	N/A	Redpoint Energy
35	90	90	0.6	Industry sources
35	90	90	0.6	Redpoint Energy
20	33	N/A	N/A	Oxera & Enviros
20	33	N/A	N/A	Climate Change Capital
40	85	N/A	N/A	Recent market data and current projects

4. Sensitivities

Table B2 details the key sensitivities used in the financial model.

Table B2: Sensitivity assumptions underlying the levelised costs for the technologies in Table B1

Technology	Sensitivity[1]	Low	High	Very High
Gas-fired plant				
CCGT	Fuel price	21p/therm	53p/therm	
Wind plant				
Onshore Wind (80MW)	Capital cost	£700/kW	£900/kW	£1000/kW
Offshore Wind (100MW)	Capital cost	£900/kW	£1550/kW	£1650/kW
Nuclear plant				
Pressurised Water Reactor	Capital cost	£850/kW	£1400/kW	£1600/kW

Real numbers in 2006 prices
1. Capital cost – excludes interest during construction and owners' costs

Additional sensitivities have been run for all of the technologies on the following variables:

- predevelopment period and cost;
- construction period and cost – including varying the interest margin and the leverage;
- operation period;
- operations and Maintenance cost;
- fuel cost;
- load factor in the first five years and thereafter;
- CO_2 price (only applies to the gas and coal technologies);
- CO_2 transport and storage cost (only applies to the technologies with CCS);
- decommissioning cost (only applies to nuclear);
- waste disposal cost (only applies to nuclear); and
- discount rate.

The sensitivity ranges and results for each technology are included in the financial model[9] and are summarised in Chart B7.

9 This is available at www.dti.gov.uk/energy/review

5. Market studies

Table B3 lists the market studies we have referred to during the building of the financial model other than internal and interdepartmental analysis.

Table B3: Source material	
Source material (in alphabetical order)	Web link (if available)
Climate Change Capital (February 2006) *Assessing the risks and implications of Government contracts for offshore wind*	
Consultation Submissions to the Energy Review (2006) British Energy, Centrica, EDF, E.ON, RWE, Scottish & Southern Energy and ScottishPower	http://www.dti.gov.uk/energy/review/consultation-submissions/page27883.html
Department for Environment, Food and Rural Affairs (April 2006) *UK Greenhouse Gas Inventory, 1990 – 2004 – Annual Report for submission under the Framework Convention on Climate Change*	http://www.airquality.co.uk/archive/reports/cat07/0605231047_ukghgi_90-04_v1.1.pdf
Department of Trade & Industry (July 2006) *DTI Energy and CO_2 Emissions Projections*	http://www.dti.gov.uk/energy/review
Department of Trade & Industry (July 2006) *Nuclear Cost Benefit Analysis*	http://www.dti.gov.uk/energy/review
Department of Trade & Industry (December 2005) *The Role of Fossil Fuel Carbon Abatement Technologies (CATs) in a Low Carbon Energy System – A Report on the Analysis Undertaken to Advise the DTI's CAT Strategy*	http://www.dti.gov.uk/energy/sources/sustainable/carbon-abatement-tech/techstrategy/page19434.html
Environmental Audit Committee (March 2006) *Keeping the Lights on: Nuclear, Renewables & Climate Change*	http://www.publications.parliament.uk/pa/cm200506/cmselect/cmenvaud/584/584i.pdf
Enviros Consulting Limited (September 2005) *The Cost of Supplying Renewable Energy*	http: www.dti.gov.uk/renewables
Oxera (January 2005) *What is the potential for commercially viable renewable generation technologies – Interim report prepared for the DTI*	http: www.dti.gov.uk/renewables
Foster Wheeler *Comparative Study of Pre and Post Combustion Decarbonisation for a Generic Combined Cycle Power Plant*	
HM Treasury (2005) *Appraisal and evaluation in Central Government, "The Green Book"*	http://www.hm-treasury.gov.uk./media/D5E/29/96.pdf

Table B3: Source material *continued*	
Source material (in alphabetical order)	Web link (if available)
Intergovernmental Panel on Climate Change (2005) *Carbon Dioxide Capture and Storage – Summary for Policymakers and Technical Summary*	http://www.ipcc.ch/activity/ccsspm.pdf
International Energy Agency (2005 Update) *Projected Costs of Generating Electricity*	http://www.iea.org/w/bookshop/add.aspx?id=196
PB Power (June 2006) *Powering the Nation – A review of the costs of generating electricity*	http://www.pbpower.net/inprint/pbpubs/powerthenation/powerthenation.htm
Public Services International Research Unit (July 2005) *The economics of nuclear power: analysis of recent studies by Steve Thomas*	http://www.psiru.org/reports/2005-09-E-Nuclear.pdf
Redpoint Energy (July 2006) *The Dynamics of UK Generation Investment*	http://www.dti.gov.uk/energy/review
Sustainable Development Commission (March 2006) *The role of nuclear power in a low carbon economy*	http://www.sd-commission.org.uk/publications/downloads/SDC-NuclearPosition-2006.pdf
Sustainable Development Commission (March 2006) *The role of nuclear power in a low carbon economy – Paper 4: The economics of nuclear power*	http://www.sd-commission.org.uk/publications/downloads/Nuclear-paper4-Economics.pdf
World Nuclear Association (December 2005) *WNA Report, The New Economics of Nuclear Power*	http://www.world-nuclear.org/economics.pdf

ANNEX C

UK CO_2 Emissions Projections

Headline CO_2 Projections to 2020

The DTI forecasts a range of possible future carbon dioxide emissions levels, which reflect four scenarios:

- a high fossil fuel price scenario
- a central fossil fuel price scenario, where the assumed prices somewhat favour gas in generation
- a central fossil fuel price scenario, where the assumed prices somewhat favour coal in generation
- a low fossil fuel price scenario.

Current CO_2 projections[1] (Table C1), which do not take account of proposals set out in the main body of this report, show emissions falling up to 2010 due to measures contained in the Climate Change Programme, but increasing to 2015 as the effect of the existing measures is more than counterbalanced by the increase in energy demand and the closure of nuclear generation plants. Emissions fall after 2015 as a significant number of coal-fired power plants retire post 2015. Taking an average of the two central scenarios, and including the EU Emissions Trading Scheme (EU ETS), the current projections suggest a 16.2% reduction on 1990 levels by 2010, which will be a shortfall of 6.2MtC from the target of a 20% reduction in emissions relative to 1990 levels.

The impact of the EU ETS is shown in the table as a separate line. It is included as the reduction in the UK allocation of allowances (-8MtC annually) announced for Phase II of the scheme. Not all of this reduction may be achieved within the UK – the scale of abatement action within the UK will depend on the level of the carbon price across the EU as a whole.

1 The current projections (DTI Energy and CO_2 Emissions Projections to 2020 – UEP26) are available at www.dti.gov.uk/energy/review/index.html

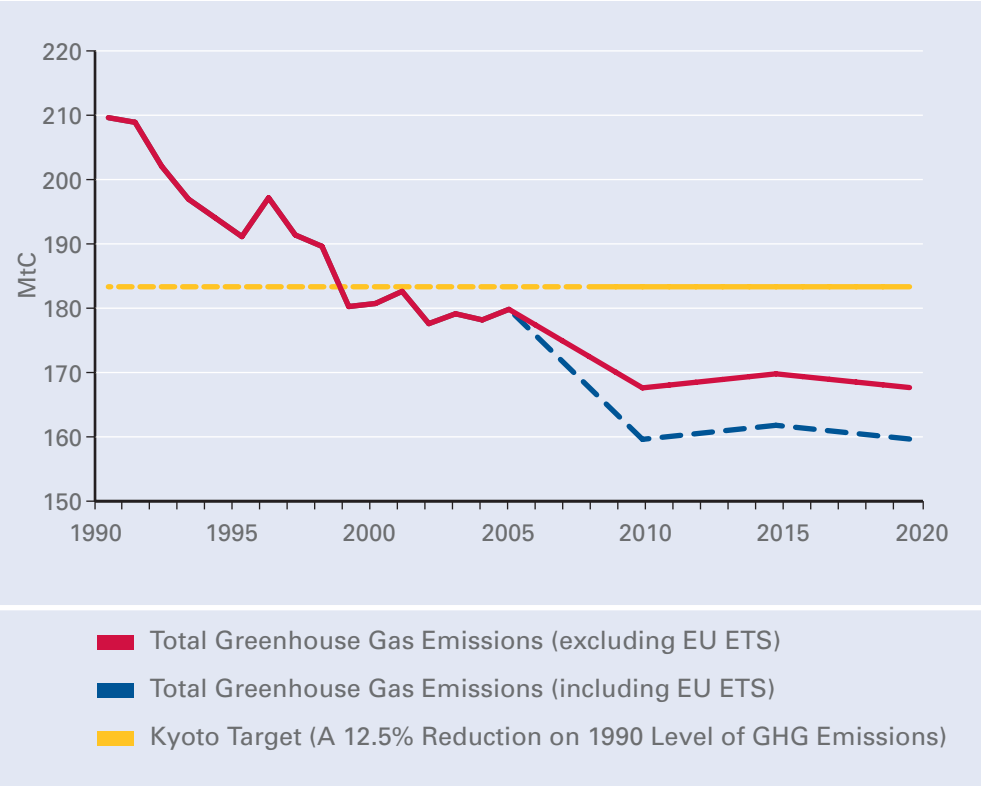
Table C1: Carbon dioxide emissions projections (1990 – 2020) (MtC)									
				Central Scenario Favourable to coal			Central Scenario Favourable to gas		
	1990	2000	2005	2010	2015	2020	2010	2015	2020
Power Stations	55.7	43.1	47.1	44.1	47.6	46.5	42.5	45.4	45.0
Refineries	5.0	4.9	5.6	5.7	5.7	5.7	5.7	5.7	5.7
Residential	21.1	23.2	22.3	19.8	19.9	20.1	20.3	20.4	20.6
Services	8.3	8.2	6.8	5.9	6.1	6.9	5.9	6.1	6.9
Industry	35.3	33.4	31.4	32.5	31.4	30.3	32.6	31.7	30.6
Road Transport	30.1	32.0	33.3	32.6	33.2	32.5	32.6	33.2	32.5
Off-road	1.6	1.4	1.5	1.5	1.4	1.4	1.4	1.4	1.4
Other transport	3.4	2.5	2.3	2.3	2.4	2.5	2.3	2.4	2.5
LUC(1)	0.8	-0.1	-0.6	-0.5	0.1	0.7	-0.5	0.1	0.7
Total (excl. EU ETS)	**161.4**	**148.6**	**149.8**	**143.9**	**147.8**	**146.5**	**142.9**	**146.4**	**145.8**
EU ETS	-	-	-	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Total (incl. EU ETS)	**161.4**	**148.6**	**149.8**	**135.9**	**139.8**	**138.5**	**134.9**	**138.4**	**137.8**
				High Scenario			Low Scenario		
	1990	2000	2005	2010	2015	2020	2010	2015	2020
Power Stations	55.7	43.1	47.1	44.4	48.3	49.5	40.9	41.6	39.9
Refineries	5.0	4.9	5.6	5.7	5.7	5.7	5.7	5.7	5.7
Residential	21.1	23.2	22.3	19.0	19.0	19.3	21.5	21.5	21.6
Services	8.3	8.2	6.8	5.9	6.1	6.9	5.9	6.1	6.9
Industry	35.3	33.4	31.4	32.2	30.7	29.5	32.8	31.9	30.7
Road Transport	30.1	32.0	33.4	32.1	32.3	31.7	33.1	34.0	33.5
Off-road	1.6	1.4	1.5	1.4	1.4	1.4	1.5	1.5	1.5
Other transport	3.4	2.5	2.3	2.3	2.3	2.4	2.4	2.5	2.6
LUC(1)	0.8	-0.1	-0.6	-0.5	0.1	0.7	-0.5	0.1	0.7
Total (excl. EU ETS)	**161.4**	**148.6**	**149.8**	**142.5**	**145.9**	**146.9**	**143.3**	**145.0**	**142.9**
EU ETS	-	-	-	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Total (incl. EU ETS)	**161.4**	**148.6**	**149.8**	**134.5**	**137.9**	**138.9**	**135.3**	**137.0**	**134.9**

(1) Land Use Change

Progress towards Kyoto

The Kyoto target is based on a basket of greenhouse gases (GHG) of which CO_2 emissions represent the largest share. The UK remains on track to comfortably go beyond its Kyoto commitment. Thus the current CO_2 projections (UEP26) combined with the emissions of other (non- CO_2) greenhouse gases suggest that in 2010 total UK greenhouse gas emissions, without the EU ETS, will be some 20% below the base year level[2]. Including the EU ETS, the projected reduction is almost 24%. Chart C1 below illustrates the projected total greenhouse gas emissions relative to the UK Kyoto target after incorporating the current CO_2 projections (UEP26).

FIGURE 1: TOTAL GREENHOUSE GAS EMISSIONS (1990-2020)



Source: DTI

2 Historic GHG figures are on the 1990-2003 inventory basis.

Revisions to Previous Projections to 2020

Since the previous CO_2 projections (UEP 21) were published in February 2006[3], there have been a number of developments arising from the Budget announcements in March 2006, developments in UK population statistics, additional policy measures announced in the Climate Change Policy Review and responses received to the February 2006 consultation on EU ETS Phase II CO_2 emissions projections[4]. There has also been a re-assessment of fossil fuel prices. Generally, fossil fuel prices in 2010 are assumed to be higher than previously and to rise further between 2010 and 2020. This is to reflect the signs that demand for oil appears more robust to higher prices than previously assumed and supply is still expected to remain relatively tight even after expected increases in supply in the next few years. Table C2 sets out the fossil fuel price assumptions used for the current CO_2 projections (UEP 26).

Table C2: Fossil fuel price assumptions

	Central Scenario Favourable to coal			Central Scenario Favourable to gas		
Real 2005 prices	Crude Oil	Natural Gas	ARA Coal	Crude Oil	Natural Gas	ARA Coal
	$/bbl	NBP p/therm	$/GJ	$/bbl	NBP p/therm	$/GJ
2005	55.0	41.0	2.4	55.0	41.0	2.4
2010	40.0	33.5	1.9	40.0	25.8	1.9
2015	42.5	35.0	1.9	42.5	27.3	1.9
2020	45.0	36.5	1.8	45.0	28.0	1.8
	High Scenario			Low Scenario		
Real 2005 prices	Crude Oil	Natural Gas	ARA Coal	Crude Oil	Natural Gas	ARA Coal
	$/bbl	NBP p/therm	$/GJ	$/bbl	NBP p/therm	$/GJ
2005	55.0	41.0	2.4	55.0	41.0	2.4
2010	67.0	49.9	2.6	20.0	18.0	1.4
2015	69.5	51.4	2.6	20.0	19.5	1.2
2020	72.0	53.0	2.6	20.0	21.0	1.0

3 These are available http://www.dti.gov.uk/files/file26363.pdf
4 A full response to the consultation will be available shortly.

Table C3 below illustrates the revised generation fuel mix consistent with the current CO_2 projections (UEP 26) for the two central cases up to 2020, which shows how coal and nuclear plant closures affect the changing mix over the next few years.

Table C3: Electricity generation fuel mix (TWh)[5]

Central favourable to gas	1990	1995	2000	2005	2010	2015	2020
coal	204	145	112	126	106	100	82
oil	15	9	2	2	2	2	1
gas	0	57	127	135	137	183	235
nuclear	59	81	78	75	73	34	26
renewables	5	6	10	17	33	53	53
imports	12	16	14	11	11	11	11
pumped storage	2	2	3	3	3	3	3
Total	**298**	**315**	**346**	**369**	**365**	**386**	**411**
Central favourable to coal	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
coal	204	145	112	126	119	116	94
oil	15	9	2	2	3	2	2
gas	0	57	127	135	122	164	219
nuclear	59	81	78	75	73	34	26
renewables	5	6	10	17	33	53	53
imports	12	16	14	11	11	11	11
pumped storage	2	2	3	3	3	3	3
Total	**298**	**315**	**346**	**369**	**362**	**383**	**407**

EU ETS and Projections

The current CO_2 emissions projections (UEP 26) have been prepared before taking account of the impact of the EU ETS[6]. The impact of including the reduction in the UK allocation now announced for Phase II is, however, shown in the summary tables above. Abatement effort within the UK will reflect the level of the carbon price and the behavioural response to that price. This carbon price will depend on the UK and other member states' allocations for 2008-12; levels and relativities of fossil fuel prices; abatement options; and availability of JI and CDM credits.

5 The coverage of the industry is major power producers plus all other renewable generators. All other generators of electricity are included within the industrial or commercial sectors.

6 Exclusion of the EU ETS has reflected a number of considerations: the UK's allocation decision for Phase II has been informed, amongst other factors, by the projections before the ETS; there is considerable uncertainty over the level of carbon price in the scheme, which will be determined by other member states allocations, as well as the UK's.

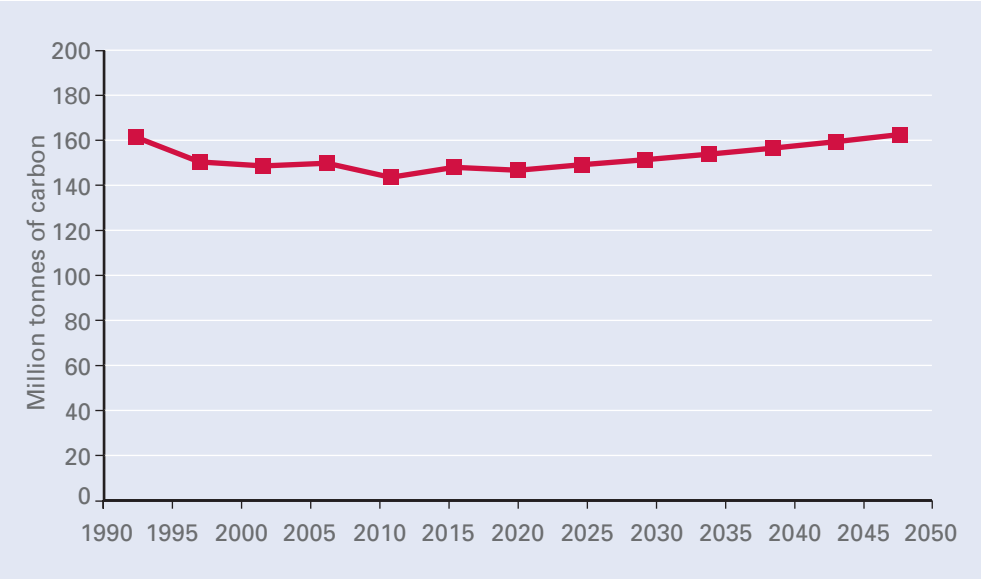
Longer Term Trends to 2050

Longer-term trends[7], excluding the proposals set out in the main body of this report, suggest that total UK energy demand and emissions are expected to continue to rise beyond 2020 (Table C4 and chart C2).

Table C4: Projected CO_2 emissions, by sector, to 2050 (MtC)

	Residential sector	Transport sector	Industry	Services	Total CO_2 emissions (including LUC)
1990	40.3	40.0	56.4	23.8	161.4
2000	38.8	41.1	48.9	20.7	143.5
2010	36.7	42.4	45.8	19.5	146.7
2030	41.1	41.5	46.6	21.6	151.4
2050	47.3	40.5	50.3	23.8	162.6

CHART C2: LONG-TERM PROJECTED CO_2 EMISSIONS, TO 2050 (BASED ON NO FURTHER GOVERNMENT ACTION)



Source: DTI, 2006

7 Detailed results and assumptions behind longer-term trends to 2050 are included in the paper on the UEP26 projections, which is available at www.dti.gov.uk/energy/review/index.html

ANNEX D

Renewables Statement of Need

We remain committed to the important role renewables have to play in helping the UK meet its energy policy goals. In this publication we are reiterating previous commitments we have made, not least in the 2003 Energy White Paper and Planning Policy Statement 22 on renewable energy (PPS22), on the importance of renewable generation and the supporting infrastructure. We intend this to reconfirm the UK Government policy context for planning and consent decisions on renewable generation projects.

As highlighted in the 2006 Energy Review report[1], the UK faces difficult challenges in meeting its energy policy goals. Renewable energy as a source of low-carbon, indigenous electricity generation is central to reducing emissions and maintaining the reliability of our energy supplies at a time when our indigenous fossil fuels are declining more rapidly than expected. A regulatory environment that enables the development of appropriately sited renewable projects, and allows the UK to realise its extensive renewable resources, is vital if we are to make real progress towards our challenging goals.

New renewable projects may not always appear to convey any particular local benefit, but they provide crucial national benefits. Individual renewable projects are part of a growing proportion of low-carbon generation that provides benefits shared by all communities both through reduced emissions and more diverse supplies of energy, which helps the reliability of our supplies. This factor is a material consideration to which all participants in the planning system should give significant weight when considering renewable proposals. These wider benefits are not always immediately visible to the specific locality in which the project is sited. However, the benefits to society and the wider economy as a whole are significant and this must be reflected in the weight given to these considerations by decision makers in reaching their decisions.

If we are to maintain a rigorous planning system that does not disincentivise investment in renewable generation, it must also enable decisions to be taken in reasonable time. Decision makers should ensure that planning applications for renewable energy developments are dealt with expeditiously while addressing the relevant issues.

1 *The Energy Challenge*, July 2006.

PPS22 makes clear that regional planning bodies and local planning authorities should not make assumptions about the technical and commercial feasibility of renewable energy projects, and that possible locations for renewable energy development must not be ruled out as unsuitable in advance of full consideration of the application and its likely impacts. Planning policies, in Regional Spatial Strategies and Local Development Documents, should not place unjustified restrictions on renewable developments; they must be flexible to cope with technological and other change over time.

However, there will be certain areas with more readily available access to renewable resources that will be more attractive for developers, for example where windspeeds are greatest. As such, as we increase the level of renewables, in line with our energy policy goals, there will be occasions when proposals are received for renewables projects that are located closely enough together potentially to have cumulative impacts. Decision makers will have to work closely together with statutory advisers, such as English Nature, to consider the handling of assessments of the cumulative impact of such proposed developments. Cumulative effects, like the impacts of individual projects, will not however necessarily be unacceptable or incapable of reduction through mitigation measures.

ANNEX E

Renewable Grid Issues

New investment in networks will be needed to accommodate greater levels of renewable generation

1. New, large renewable plants are likely to connect into the transmission network, particularly in Scotland where the 132kV system is categorised as transmission. Because of the geographical concentration of wind resource in Great Britain, there are likely to be complex connection issues accommodating large amounts of wind generation, in particular. Substantial increases in wind generation will therefore require parallel developments in transmission infrastructure.

2. The Government has long recognised these issues. DTI published the RETS study in June 2003 and RETS Revisited in November 2005. Ofgem also published a report between price reviews in December 2004 (Transmission Investment for Renewable Generation) that approved funding for over £560m capital expenditure, including the upgrading of the Beauly-Denny line. These upgrades could allow the connection of a further 6.3GW in Scotland, of which 1.5GW has already been consented and installed.

3. The Government also recognises that planning approval for new overhead lines will be increasingly required if renewable generation is to continue growing (see Chapter 7). In the past, approval has sometimes proven to be problematic and this is likely to be the case if the status quo remains. Increased uncertainty, risk and therefore cost can all influence developers' investment decisions.

Grid requirements will be specific to particular regions based on available wind resource, existing capacity and location within the system[1]

4. The need for new transmission capacity is determined using the criteria stated in the SQSS which was developed prior to the increase of intermittent sources. Work is currently underway to raise the capacity on the transmission network linking England and Scotland. Longer term it is possible that existing capacity may need to be doubled – provided it is efficient and economic to do so – through construction of two new major onshore or offshore links. This would allow a further 6 – 8GW of capacity. Additional generation could require substantial further reinforcement dependent upon the size and location of the new generation and any changes to existing generation and demand in the region.

1 Figures are supplied by National Grid and should be considered as broad estimates. No detailed studies have been undertaken to inform this work.

5. In northwest England there is currently very little network capacity available for new generation without significant reinforcement. Work is underway at Heysham that will allow an extra 1GW of renewable capacity, at a cost of £75m. Additional generation of around 2GW, either in the local area or in Scotland, will require reinforcements near to Penwortham and the Mersey Ring at a further cost of around £275m. The transmission network around the Thames Estuary and The Wash is currently heavily congested. National Grid believe that substantial upgrading will be required to accommodate the significant, predicted amounts of demand for capacity, around 3GW, in The Wash and in the Thames Estuary at a cost of around £600m. These very indicative figures are summarised below and show which costs are potentially significant.

Table E1: Potential costs to accommodate additional renewable generation

Area	Cost (£m)	Additional capacity (GW)	Cost per GW (£m)
NW England	75	1	75
NW England	275	2	137
Scotland	375	4-5	75-94
Wash/Thames	600	3	200
Scotland	1,000-2,000	6-8	125-333
TOTAL	**2,325-3,325**	**16-19**	**145-175**

It should be noted that these costs are not based on firm analysis. Further independent and detailed appraisal would be required before any approval for funding.

Transmission upgrades alone may not be sufficient to ensure continued growth in large-scale renewable generation

6. The Government is aware of a number of significant and pressing issues that need resolution in the context of the 2010 renewable energy target. These include current Final Sums Liability (FSL) arrangements and the "queue" created by the confluence of the Government's renewable targets, the Renewable Incentive Scheme and transitional arrangements for BETTA, given the lack of excess capacity and the time required to consent and build new transmission capacity. Resolution of these issues is imperative for the potential of renewables to be maximised and targets achieved. Ofgem and National Grid are working to resolve these issues. It is crucial that this progresses to a satisfactory conclusion.

Should renewable generation pay only a proportion of the Transmission Use of System charges paid by conventional generation?

7. All generation connected to the transmission system is required to pay charges according to investment cost reflective pricing principles – the greater the cost impact to the network the higher the transmission charge. These TNUoS charges are therefore inextricably linked to the future cost of network investment, largely defined by transmission companies' planning investment criteria.

8. Work sponsored by the DTI suggests that renewable generation may drive the need for transmission reinforcement to a lesser degree than conventional generation – which implies transmission charges should be lowered. There are two main reasons why this may be the case. First, the contribution of renewable generation to security of supply is potentially very different from conventional generation (expanded below). Although wind generation may displace energy produced by conventional plant, its ability to displace conventional network *capacity* is limited even at substantial penetrations, due to its variability. (At the low penetrations we currently have, supply displacement is similar to that of capacity displacement.) Therefore, the need for transmission network capacity to enable wind generation to contribute to security of supply would be less than conventional plant.

9. Second, when calculating the proportion of the utilisation of transmission capacity by wind and conventional plant, during peak-flow condition on a probabilistic basis, wind occupies less transmission due to its low load factors (around 35%). Wind occupies the same capacity when generating but is less likely to be operating at peak.

10. Other work (forthcoming from National Grid) suggests that network investment costs of variable and conventional generation are similar. What is agreed is that transmission charges should be cost reflective. If it can be categorically shown that classes of generation (including renewables) are not paying an amount equal to the costs they impose on the system, the TNUoS charge should be adjusted appropriately. Alternatively if preferential treatment were given for renewables this should be made explicit and the cross-subsidy justified.

11. The Government notes that there is currently a review of the GB Security and Quality of Supply Standard (SQSS) and work underway by National Grid on Condition 3 with regard to treating intermittent generation, both of which have an impact on this issue. The Government supports this work and the current transmission charging methodology principle of cost reflectivity.

Do current transmission reinforcement and connection standards have potential to overstate necessary investment requirements for renewable generation?

12. National Grid's transmission investment standards are designed to ensure a safe and secure transmission network under a wide range of contingencies. A report sponsored by the DTI shows that application of these standards could be inappropriate in the case of renewables. There may exist the potential for the system to be "over-engineered" in some instances[2].

13. Less reinforcement may be required for renewable generation because wind (or marine) is variable, has low utilisation compared with most conventional plant and therefore makes less contribution to ensuring that winter peak demands can be met reliably. Currently, the transmission companies' investment standards take only partial account of this, leading to the possibility of transmission reinforcements being overestimated and charges too high.

14. The Government is aware of a review of the SQSS by National Grid, and a technical sub-group has been set up by DTI/Ofgem to assist with decisions relating to offshore transmission system security requirements.

Does transmission access policy cause unnecessary delays in connection?

15. Transmission reinforcements are currently required to be in place before renewable generation can connect and capacity allocated – "invest then connect". This, together with the particular application of the transmission companies' network planning standards, results in a transmission system designed to handle the output of both conventional and renewable generation simultaneously. The invest and connect regime means that a party wishing to connect to the system must often wait until necessary reinforcements are complete which can lead to projects being given connection dates later than when their generation development is complete.

16. This policy would be justified if renewable generation contributed to overall system security to the same extent as conventional. The role of renewable generation is not primarily to contribute to system security, but to displace the output of conventional fossil-fuel generation. In a future system with significant amounts of renewable generation, it will not be possible for all renewable and conventional generation to operate simultaneously. Nuclear and some conventional generation operates at base load and renewable generation operates whenever its primary "fuel" is available to displace fossil fuels and reduce carbon emissions. Some conventional fossil-fired generation will increasingly adopt a regulating role, operating when the availability of renewable energy is low and reducing its output to accommodate increases in output of renewable generators.

2 Centre for Distributed Generation and Sustainable Energy, "Transmission Planning and Operational Standards with Intermittent Generation".

17. This mode of operation suggests that, rather than designing the transmission system on today's "invest and connect" basis, it could be designed to "connect and manage", with renewable and conventional generation "sharing" transmission access.

18. In this situation, transmission access could be granted at an earlier – fixed – point (e.g. a number of years after application or after consents received). These options were discussed in a recent access reform report by Ofgem[3]. From the point of connection the consequences of accommodating the generation would need to be managed by the system operator. There may be some increased costs from balancing the system through constraining-off generators and contracting for reserve services. The constraint costs could be significant and would need to be assessed in developing this approach.

19. The connect and manage approach may also increase competition and allow a greater volume of renewable generation to connect. It is estimated that it could advance the connection of up to 2GW of renewable generation by between 2 and 3 years. System security would not be compromised – an excess of generation capacity would exist, managed by constraining conventional generation whenever necessary.

20. A "connect and manage" approach could also release the hidden "non-firm" capacity of the transmission system. This capacity arises because of the premise underpinning the design of the transmission system – that security should not be compromised in the event of the worst credible transmission fault.

21. These fault conditions, while onerous, are extremely infrequent and consequently Transmission capacity normally operates at relatively low utilisation. Resulting non-firm capacity could be utilised provided adequate means of recovery were in place to respond to the occurrence of a credible fault, such as arrangements for automatic generator disconnection. The variable output and low load-factor characteristics of renewable generation are well suited to the utilisation of non-firm capacity.

22. Given the recent introduction of BETTA we are not advocating a fundamental review of the operation of the market. However, with the Review's mandate to look at long-term issues renewable generation grows as a proportion of the total, some conventional plant will have very low load factors. The market needs to ensure arrangements are in place to ensure the necessary reserve is maintained. This issue has been picked up elsewhere within the Review.

3 Access Reform in Electricity Transmission: *Working group report and next steps, May 2006* (Ref No. 83/06a) and *A framework for considering reforms to how generators gain access to the GB electricity transmission system: A report by the Access Reform Options Development Group April 2006, May 2006 (Ref No. 83/06b),* both available at www.ofgem.gov.uk

More research into managing variability and capacity contribution of renewable generation seems useful

23. A recent UKERC report "Costs and Impacts of Intermittency" concluded that the likely cost of additional electricity balancing services required to manage the variability of renewable sources, should such sources reach ~20% of supply, was in the range 0.2 – 0.3p/kWh of wind output (0.5 – 0.8 p/kWh in total). Smeared across all generation the burden on consumers would be about 0.1 – 0.5 p/kWh. These costs suggest an increase in domestic electricity bills of around 1%. Under a connect and manage approach, constraint costs could also be significant, depending on the detail of the approach adopted and this would need to be evaluated.

24. The UKERC report implies some important issues for policymakers. It would be helpful for the effect of intermittent generation to be better monitored in the future and the effectiveness of market mechanisms in delivering adequate system margin should be kept under review.

25. While not high, the costs of intermittency could be expected to increase with penetration of renewables above 20%. Furthermore, there appear to be ways to mitigate these costs through technologies such as "dynamic demand" which would provide a responsiveness of electricity demand to variations in system frequency, or the increased application of electricity storage. In turn: dynamic demand includes such possibilities as appliances that can vary their load with frequency (imbalances in generation and demand result in changes in system frequency), reducing the need to carry spinning reserves; developments in storage would allow excess energy during windy periods to be stored and released during periods of calm.

26. The Government accepts that further research into technical and commercial issues may be useful here. Areas include the impact of clustering in a UK context, adequacy of current reliability criteria and the extent to which market intervention may be required to ensure the availability of adequate levels of conventional generation. These were identified in the draft ESTISG Report, issued by the DTI in November last year and are the subject of a proposal for funding by the Centre for Distributed Generation and Sustainable Electrical Networks.

ANNEX F

Energy Review Consultation and Responses

1. As part of the Energy Review, the Government launched the Energy Review consultation on 23rd January 2006. The accompanying document: *Our Energy Challenge: Securing clean, affordable energy for the long-term* sought views on the measures needed by 2020 and beyond, to meet the energy goals set out in the 2003 Energy White Paper.

2. The consultation document invited responses to be made on six key areas of energy policy: meeting carbon goals, reliable energy supplies, nuclear new build, low carbon technologies, fuel poverty and international action.

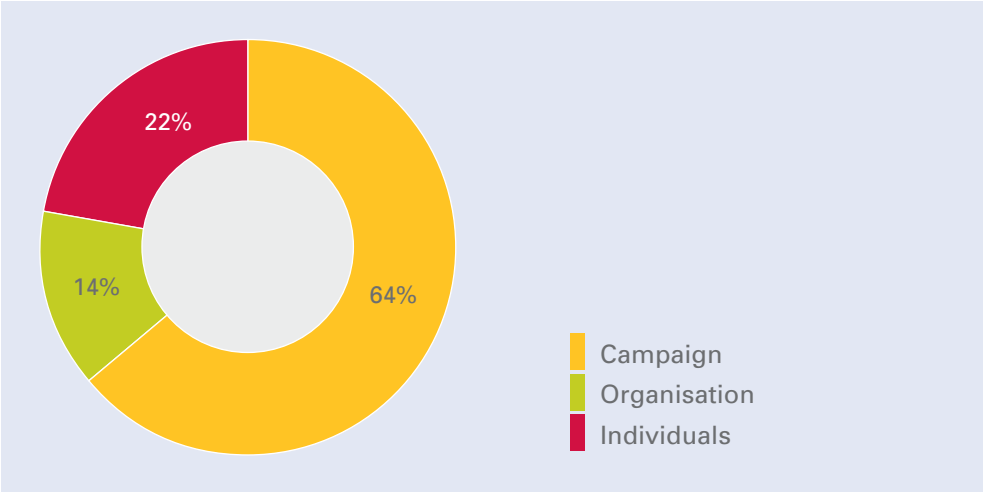
3. There were over 5,300 written responses from individuals, businesses, academics, non-governmental organisations and other organizations.

4. Key message from these responses included:

- strong support for further efforts on energy saving and efficiency across all sectors including households, transport, and business;
- on electricity generation, widespread support for renewables and also for coal, particularly through clean coal technology;
- no consensus on nuclear new build. Most individuals (including some participating in campaigns) were opposed, with the management of radioactive waste the most frequently cited concern. But many respondents were in favour of the UK maintaining its current level of nuclear capacity;
- concern about the risks of energy from increased dependence on imported fuels.

5. All the responses to the consultation are available on the DTI website at: http://www.dti.gov.uk/energy/review/consultation-submissions/page27883.html

CHART F1: BREAKDOWN OF RESPONDENT TYPES



6. In drawing up its proposals, the Government has attempted to address key concerns and issues raised in the consultation. Each response was read and logged. To help with the analysis of the key messages, and to produce a summary of the responses, we appointed AEA Technology Environment through a competitive tender. The summary of consultation responses includes a breakdown of the views expressed by individuals, those responding to campaigns, and businesses, energy operators, local government etc. The summary is available on the DTI website at: http://www.dti.gov.uk/energy/review

Stakeholder and public engagement

7. Over the consultation period the Energy Minister and the Review team were involved in around 400 Review-specific activities, involving at least 1,000 stakeholders. This included the organisation of a programme of stakeholder seminars across the country and a series of round table discussions between key stakeholders and the Minister. Each event took a different energy topic as the focus, but stakeholders also had the opportunity to comment on the Energy Review more broadly.

8. Invitees included representatives from unions; energy providers; energy generators; industry associations; network operators; non-governmental organisations with an interest in energy, environment, or fuel poverty issues; regulatory bodies; official advisory bodies to the Government; national, devolved, regional and local Government and Government Agencies; think tanks and academia.

9. Reports from the seminars can be found on the DTI website.

10. On public information and engagement, action was taken through a range of national and local media to stimulate public debate on the Energy Review. Over the 12 week consultation period the Minister and the Secretary of State took part in 88 media activities specific to the Review. This included interviews with national newspapers and on television; participation in local radio shows and phone-ins; and articles in local newspapers and specialist magazines.

11. We produced an introductory booklet describing the challenges that the Review is facing in accessible language, which was distributed through community organisations across the country. The Review website also provided a five minute summary video and a fact sheet providing basic information on the different sources of energy used in the UK. Finally people were able to submit their responses to the consultation in a variety of ways – online, via email or in writing.

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