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ENERGY WHITE PAPER

Our energy future -
creating a low
carbon economy

ENERGY WHITE PAPER Our energy future - creating a low carbon economy



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Our energy future -
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February 2003

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Foreword



Energy is vital to a modern economy. We need energy to heat and light our homes, to help us travel and to power our businesses. Our economy has also benefited hugely from our country's resources of fossil fuels - coal, oil and gas.

However, our energy system faces new challenges. Energy can no longer be thought of as a short-term domestic issue. Climate change - largely caused by burning fossil fuels - threatens major consequences in the UK and worldwide, most seriously for the poorest countries who are least able to cope. Our energy supplies will increasingly depend on imported gas and oil from Europe and beyond. At the same time, we need competitive markets to keep down costs and keep energy affordable for our businesses, industries, and households.

This white paper addresses those challenges. It gives a new direction for energy policy. We need urgent global action to tackle climate change. We are showing leadership by putting the UK on a path to a 60% reduction in its carbon dioxide emissions by 2050. And, because this country cannot solve this problem alone, we will work internationally to secure the major cuts in emissions that will be needed worldwide.

Our analysis suggests that, by working with others, the costs of action will be acceptable - and the costs of inaction are potentially much greater. And as we move to a new, low carbon economy, there are major opportunities for our businesses to become world leaders in the technologies we will need for the future - such as fuel cells, offshore wind and tidal power. Science and technology are vital, and we will be supporting further research and development in these areas.

In parallel, we need access to a wide range of energy sources and technologies and a robust infrastructure to bring the energy to where we want to use it. We will maintain competitive markets in the UK and press for further liberalisation in Europe. And we renew our commitment that no household in Britain should be living in fuel poverty by 2016-18.

This white paper is a milestone in energy policy. It is based on the four pillars of the environment, energy reliability, affordable energy for the poorest, and competitive markets for our businesses, industries and households.

This white paper sets out a strategy for the long term, to give industry the confidence to invest to help us deliver our goals - a truly sustainable energy policy.



Section One

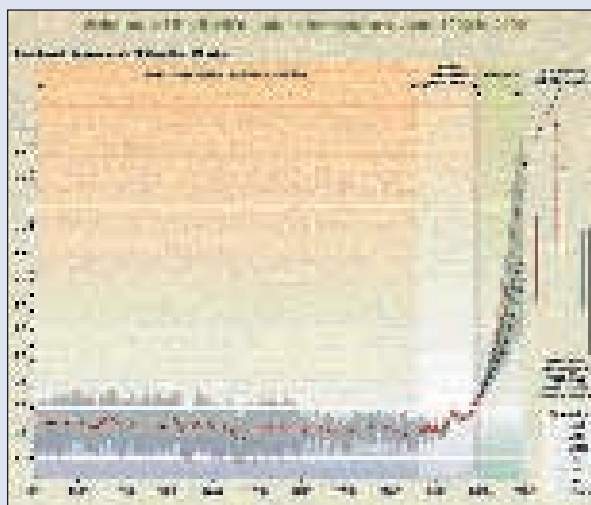
Overview

Chapter 1 Cleaner, smarter energy

- 1.1 Our country needs a new energy policy. Despite the improvements we have made over the last five years, today's policy will not meet tomorrow's challenges. We need to address the threat of climate change. We must deal with the implications of reduced UK oil, gas and coal production, which will make us a net energy importer instead of an energy exporter. And over the next twenty years or so we will need to replace or update much of our energy infrastructure.
- 1.2 With these challenges, however, come new opportunities. The opportunity to shift the UK decisively towards becoming a low carbon economy where higher resource productivity - producing more with fewer natural resources and less pollution - will contribute to higher living standards and a better quality of life. The opportunity to develop, apply and export leading-edge technologies, creating new businesses and jobs. And the opportunity to lead the way, in Europe and internationally, in developing environmentally sustainable, reliable and competitive energy markets that will support economic growth in every part of the world.
- 1.3 From heating and lighting to transport, industry and communications, energy is fundamental to almost everything we do. We expect it to be available whenever we want it, to be affordable, safe and environmentally sustainable. It is only when something goes wrong - for instance, when families are left without heating and light after severe storms or when the lights go out in California - that we realise how much modern industrialised countries depend upon extremely complicated energy systems.
- 1.4 Until the 1990s the energy system in the UK - as in most other countries - was largely owned and controlled by Government. Today the UK has one of the most open energy markets in the world. Open and competitive markets will remain vital to delivering the energy we need. But it is Government's responsibility to set the overall goals for UK energy policy and to ensure that our energy markets and other policies deliver those goals. Energy producers, investors, business and consumers need a clear, settled, long-term framework within which they can plan and make decisions with confidence.
- 1.5 The new energy policy that we set out in this white paper is designed to provide this. It reflects, and will reinforce, our wider commitment to sustainable development¹ which challenges us to find ways to achieve economic, social and environmental objectives at the same time.
- ## The challenges we face...
- 1.6 The first challenge we face is **environmental**. Climate change is real. Levels of carbon dioxide (CO₂) in the atmosphere, one of the main causes of climate change, have risen by more than a third since the industrial revolution and are now rising faster than ever before. This has led to rising temperatures: over the 20th century, the earth warmed up by about 0.6°C largely due to increased greenhouse gas emissions from human activities. The 1990s were the warmest decade since records began.

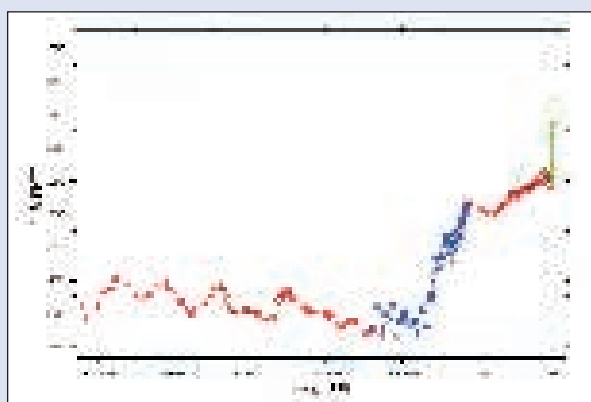
¹ Our sustainable development policy is set out in *A better quality of life: a strategy for sustainable development for the UK*, May 1999.

Chart 1.1
Variations of the Earth's Surface Temperature: Years 1000 to 2100



Variations in the earth's surface temperature from year 1000 to 2000. Line shows 50-year average.² "SRES envelope" refers to the range of emission scenarios used as a basis for the climate change projections in the IPCC Working Group I contribution to the Third Assessment Report.

Chart 1.2
Carbon Dioxide Levels over the last 60,000 Years



Source: University of Berne and National Oceanic and Atmosphere Administration.

² Source: IPCC 2001. Climate change 2001: Synthesis Report. A contribution of Working Groups I, II and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

1.7 The rise in temperatures has been accompanied by changes in the world around us:

- ice caps are retreating from many mountain peaks like Kilimanjaro;
- global mean sea level rose by an average of 1-2mm a year during the 20th century;
- summer and autumn arctic sea ice has thinned by 40% in recent decades;
- global snow cover has decreased by 10% since the 1960s;
- El Nino events³ have become more frequent and intense during the last 20-30 years;
- usage of the Thames Barrier has increased from once every two years in the 1980s to an average six times a year over the past 5 years; and
- weather-related economic losses to communities and businesses have increased ten-fold over the last 40 years.

1.8 In this century, without action to reduce emissions, the earth's temperature is likely to rise at a faster rate than any time in the last 10,000 years or more. In the UK, the risks of droughts and flooding are likely to increase. Sea levels will rise, so that extreme high water levels could be 10 to 20 times more frequent at some parts of the east coast by the end of the century. Worldwide, the consequences could be devastating, especially in the developing world where many millions more people are likely to be exposed to the risk of disease, hunger and flooding. In addition, there is a risk of large scale changes such as the shut-down of the

³ El Nino events change the weather patterns experienced in the regions around the tropical Pacific. This can affect rainfall patterns, and people living in the region can find themselves having to deal with unusually wet or dry conditions.

Gulf Stream or melting of the West Antarctic ice sheet, which although they may have a very low probability of occurring, would have dramatic consequences.

- 1.9 We cannot escape some climate change. But the worst effects can be avoided if greenhouse gases in the atmosphere are stabilised instead of being allowed to go on increasing. The UNFCCC³ and its Kyoto Protocol demonstrate that it is possible to reach global agreement on action, but far more needs to be done. The UK will continue to show leadership but it cannot solve this problem alone. UK emissions of carbon dioxide currently account for only about 2% of the global total. Our own actions will have no impact on climate change unless they are part of a concerted international effort. A wider effort is also necessary, for example in bringing forward technological changes, to keep down costs to the UK and to avoid compromising our competitiveness.

We will therefore continue to work with other countries to establish both a consensus around the need for change and firm commitments to take action to reduce carbon emissions world wide within the framework of the UNFCCC. A key objective of the UK's foreign policy in future will be to secure international commitment to this ambition. We also need to continue to develop our understanding of climate change, so that we can forecast with greater precision the effects which must be mitigated. We are investing in climate change research and recognise that this is a crucial underpinning of the knowledge base which informs our energy policies.

- 1.10 Our ambition is for the world's developed economies to cut emissions of greenhouse gases by 60% by around 2050. **We therefore accept the Royal Commission on Environmental Pollution's (RCEP's) recommendation that the UK should put itself on a path towards a reduction in carbon dioxide emissions of some 60% from current levels by about 2050⁵.**

Until now the UK's energy policy has not paid enough attention to environmental problems. Our new energy policy will ensure that energy, the environment and economic growth are properly and sustainably integrated. In this white paper, we set out the first steps to achieving this goal.

- 1.11 We can get to a 60% cut in emissions by 2050 in a number of ways. But leaving action until the last minute is not a serious option. If we do not begin now, more dramatic, more disruptive and more expensive change will be needed later on. We need early, well-planned action to provide a framework within which businesses and the economy generally, including the jobs and skills base, can adjust to the need for change. This will for example allow business to plan to act in the course of normal capital replacement cycles. It will also encourage new technologies to come forward to help to meet the challenges we face.

- 1.12 We have analysed carefully the likely impacts on the UK economy of cutting emissions by 60% by 2050. A good deal of caution is needed in looking at economic changes over such a long period and given the sensitivity

⁵ RCEP's recommendation of putting the UK on a path to 'reducing carbon dioxide emissions by some 60% from current levels by about 2050' was based on a more detailed calculation of 58% reductions from 1997 levels. This would lead to 2050 emissions of 64 million tonnes of carbon (MtC). The Kyoto Protocol, and the UK's current domestic targets, use 1990 as a baseline. A precise reduction of 60% in emissions from 1990 would result in emissions of 65.8 MtC in 2050. As the RCEP recommendation implies, absolute precision five decades before 2050 is not possible. This white paper uses 'around 65 million tonnes' to describe the level of carbon emissions which a 60% cut would deliver by 2050.

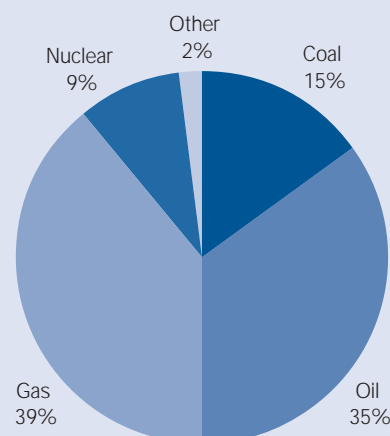
⁴ United Nations Framework Convention on Climate Change.

of the analysis to the assumptions made. But an extensive review by the Intergovernmental Panel on Climate Change suggests that action aimed at stabilising carbon dioxide atmospheric concentrations at no more than 550ppm would lead to an average GDP loss for developed countries of around 1% in 2050⁶. This figure should, however, be more than offset by the reduction in the risks, eg of flooding, associated with climate change. The outcome of our UK analysis is consistent with that review, assuming that the world's leading industrial nations act together. It suggests that the cost impact of effectively tackling climate change would be very small - equivalent in 2050 to just a small fraction (0.5-2%) of the nation's wealth, as measured by GDP, which by then will have tripled as compared to now.

1.13 The second challenge is the **decline of the UK's indigenous energy supplies** - oil, gas, nuclear and coal. Our current demand for primary energy (ie before transformation, eg into electricity) is shown below. Already we import nearly half the coal we use. Much of the UK's economically viable deep mined coal is likely to be exhausted within ten years. By around 2006 we will also be a net importer of gas and by around 2010 of oil. By 2020 we could be dependent on imported energy for three quarters of our total primary energy needs.

1.14 As we shift from being a net energy exporter to being once again a net energy importer we may become potentially more vulnerable to price fluctuations and interruptions to supply caused by regulatory failures, political instability or conflict in other parts of the world. But being an energy importer does not

Chart 1.3
Primary Energy Demand in 2002, UK



Source: DTI provisional 2002 data based on Digest of UK Energy Statistics, table 1.1

necessarily make it harder to achieve energy reliability⁷. Of the world's leading industrial nations only two - Canada and the UK - are net energy exporters. The others have all achieved economic growth as energy importers. We will be able to do the same - just as we did before North Sea oil and gas. The best way of maintaining energy reliability will be through energy diversity. We need many sources of energy, many suppliers and many supply routes. Renewables and smaller-scale, distributed energy sources - eg micro-CHP⁸ and fuel cells - will help us avoid over-dependence on imports and can make us less vulnerable to security threats.

1.15 Norway will be a major source of our gas imports over the next decade. But we will also need to look for supplies from elsewhere eg from Russia, the Middle East, North Africa and Latin America. This trade in energy will involve relationships of mutual dependence -

⁶ Report of Working Group III of Intergovernmental Panel on Climate Change, Mitigation, 2001.

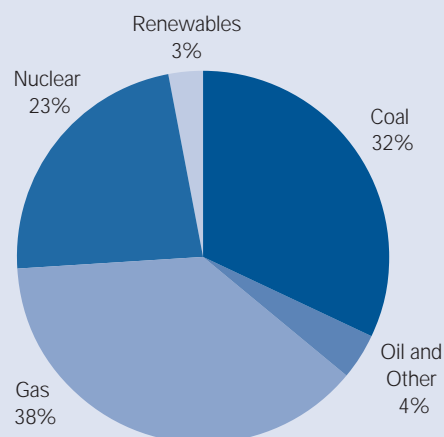
⁷ The phrase energy reliability is used in this white paper to encompass all aspects of energy security of supply.

⁸ Combined Heat and Power plant.

their energy being as important to us as their income from us is to them. Our growing interdependence also means that securing reliable energy supplies will need to be an increasingly important part of our European and foreign policy. We will work internationally to promote regional stability, economic reform, open and competitive markets and appropriate environmental policies in the regions that supply most of the world's oil and gas - Russia, the Middle East, North Africa and Latin America. We have already secured a commitment to energy liberalisation in the European Union for industrial customers by 2004 and overall by 2007. This is vital not only to improve our own access to diverse sources of supply but also to allow UK companies to compete in wider markets.

1.16 Our third challenge is the need to **update much of the UK's energy infrastructure** over the next two decades. During the 1990s there was significant new investment in generating capacity, especially for gas-fired plant. This was a response to the high electricity prices and market structure of the time. Some generating capacity has since been mothballed and interest in building new plant, other than renewables, has declined. But looking ahead, there are further changes in prospect. European measures to limit carbon emissions and to improve air quality are likely to force the modernisation or closure of most older coal-fired plant. In the absence of new build or life extensions, nuclear power's share of electricity production will shrink from its current level: there would be only one plant still operating by 2025. And renewables will become a more significant source of electricity as we seek to tackle climate change. Our current generation mix is shown in chart 1.4 below.

Chart 1.4
Electricity Generation in 2002, UK



Source: DTI estimates for 2002 on gross supplied basis, based on Digest of UK Energy Statistics, table 5.6.

1.17 Over the coming years, substantial investment will also be required in other parts of our energy infrastructure. The electricity distribution networks - designed for one-way transmission from large, centralised power stations to consumers - will need to adapt to more renewables often in peripheral parts of the country or offshore and to small-scale, decentralised power generation in homes and businesses, sometimes drawing from the grid, sometimes contributing to it. As we adapt to becoming a net gas importer we will need additional connections to supplies of both piped and liquefied natural gas (LNG) from a range of sources. In the longer-term, as we potentially move to different fuels for vehicles (eg compressed natural gas or hydrogen), major investments will be needed in the fuel delivery infrastructure.

The goals of our new energy policy...

1.18 As we address these three challenges, we will have four goals for our energy policy:

- **to put ourselves on a path to cut the UK's carbon dioxide emissions - the main contributor to global warming - by some 60% by about 2050, as recommended by the RCEP, with real progress by 2020;**
- **to maintain the reliability of energy supplies;**
- **to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and**
- **to ensure that every home is adequately and affordably heated.**

1.19 We believe these four goals can be achieved together. As far as possible we will ensure that the market framework and policy instruments reinforce each other to achieve our goals. Energy efficiency is likely to be the cheapest and safest way of addressing all four objectives. Renewable energy will also play an important part in reducing carbon emissions, while also strengthening energy security and improving our industrial competitiveness as we develop cleaner technologies, products and processes.

1.20 There will inevitably from time to time be tensions between different objectives. For example, extremely high energy prices would undoubtedly promote energy efficiency and thereby help to reduce carbon emissions. But they would also have a negative effect on people on low incomes and on business. There is no simple mechanism for

determining the relative 'weights' of differing objectives. But our approach is guided by the following considerations:

- significant damaging climate change is an environmental limit that should not be breached. We need to keep the UK on a path to 60% cuts in carbon dioxide emissions by 2050;
- reliable energy supplies are fundamental to the economy as a whole and to sustainable development. An adequate level of energy security must be satisfied at all times in both the short and longer term;
- liberalised and competitive markets will continue to be a cornerstone of energy policy. Where the market alone cannot create the right signals (for example on the environment) we will take steps that encourage business to innovate and develop new opportunities to deliver the outcomes we are seeking; and
- our policies should take account of impacts on all sectors of society. Specific measures will be needed for particular groups of people (for example to support those for whom energy bills form a disproportionate burden).

The fuel mix...

1.21 We do not propose to set targets for the share of total energy or electricity supply to be met from different fuels. We do not believe Government is equipped to decide the composition of the fuel mix. We prefer to create a market framework, reinforced by long-term policy measures, which will give investors, business and consumers the right incentives to find the balance that will most effectively meet our overall goals.

1.22 We recognise, however, that this approach is not enough on its own. In particular, specific measures are needed to stimulate the growth in renewable energy that will allow it to achieve the economies of scale and maturity that will significantly reduce its costs. In January 2000 we announced our aim for renewables to supply 10% of UK electricity in 2010, subject to the costs being acceptable to the consumer. We introduced the Renewables Obligation (which requires suppliers in England and Wales to obtain an increasing proportion of electricity from renewables year on year) in April last year. We also exempted renewable generation from the Climate Change Levy. By 2010 these measures will provide the renewables industry with support worth around £1 billion a year. This is designed to deliver the required expansion in renewables by then. In this white paper we set the ambition of doubling renewables' share of electricity generation in the decade after that. In order to achieve this and to ensure that renewables make a growing contribution to the fuel mix in the longer term it will be essential to maintain a healthy research base.

1.23 In reducing carbon dioxide emissions, our priority is to strengthen the contribution of energy efficiency and renewable energy sources. This white paper sets out the policies we believe are necessary to achieve that. They mean energy efficiency and renewables will have to achieve far more in the next 20 years than they have until now. We believe that such ambitious progress is achievable. But it is uncertain.

1.24 Nuclear power is currently an important source of carbon-free electricity. However, its current economics make it an unattractive option for new, carbon-free generating capacity and there are also important issues

of nuclear waste to be resolved. These issues include our legacy waste and continued waste arising from other sources. This white paper does not contain specific proposals for building new nuclear power stations. However we do not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon targets. 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 our proposals.

1.25 Coal fired generation will also have an important part to play in widening the diversity of the energy mix provided ways can be found materially to reduce its carbon emissions. We will continue to support relevant research projects, including internationally, to develop options for cleaner coal technologies and for carbon capture and storage. Domestic coal production is likely to continue to decline as existing pits reach the ends of their geological and economic lives.

1.26 However, where there is the potential for coal companies to make worthwhile investments, they have to date been prevented by EU rules from seeking government help in doing so. In 2002 we negotiated the flexibility we require at an EU level to correct this anomaly. We now propose to introduce an investment aid scheme to help existing pits develop new reserves, where they are economically viable and help safeguard jobs.

How we will achieve our goals...

1.27 To achieve our goal of **reducing carbon emissions** we need to continue to decouple economic growth from energy use and pollution. Since 1970, overall energy

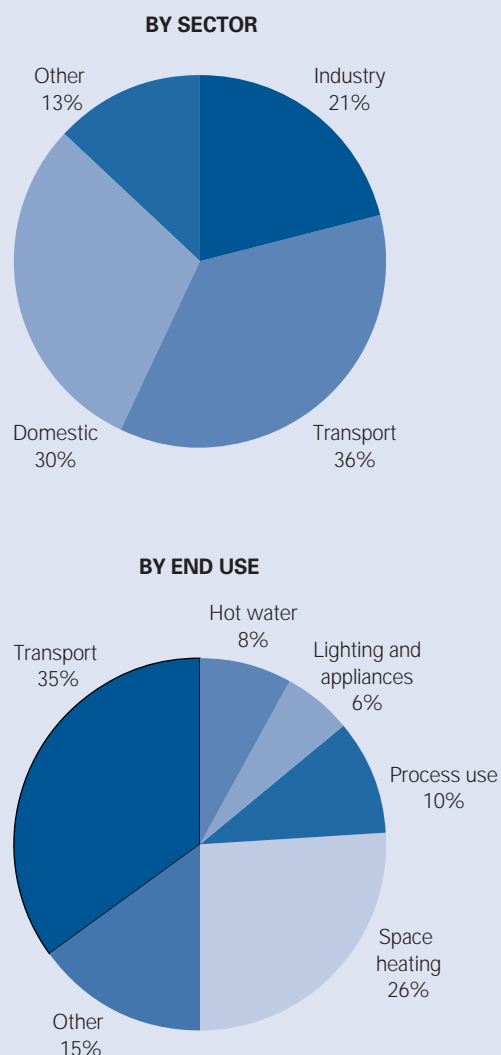
consumption in the UK has increased by around 15%, while the size of the economy has doubled. In future we need to continue and accelerate this trend.

1.28 Discussions under the UNFCCC to tackle climate change beyond 2008-12 will start soon. On the basis of existing policies, including the full effect of our current Climate Change Programme, we would expect UK carbon dioxide emissions of some 135 million tonnes of carbon (MtC) in 2020. To be consistent with demonstrating leadership in the international process, we expect to aim for cuts in carbon of 15-25 MtC below that by 2020.

1.29 We believe it is possible to achieve this goal by reducing the amount of energy we consume, together with a substantial increase in renewable energy. Our current energy use is illustrated in chart 1.5 below. By making our intentions clear we aim to provide the signals needed for firms to invest - and to help British manufacturers to be ahead of the game in developing the green technologies that we expect to play a large part in the world's future prosperity. In this white paper, we set out measures to implement the objectives for 2010 set out in the existing Climate Change Programme, and to provide a foundation for the further carbon cuts we will need by 2020.

1.30 Central to the future market and policy framework will be a carbon emissions trading scheme. We have already launched our own voluntary trading scheme in the UK. But from 2005 electricity generators, oil refineries and other industry sectors are expected to be part of a much larger Europe-wide scheme. By setting caps on emissions the scheme will provide clear incentives for investment in energy efficiency and cleaner technologies

Chart 1.5
Final Energy Consumption in 2002, UK



Source: DTI, provisional, data for 2000. End use data for 2000.

at the lowest cost. We will be encouraging expanded opportunities for emissions trading at all levels. In particular, we will work with our European partners to extend where appropriate the coverage of the EU scheme in due course. We will consider the issues involved in the linkages between tax and tradeable permit schemes further as the position on the EU emissions trading scheme becomes clearer.

- 1.31 On its own emissions trading will not be enough to deliver our environmental goals. We will need additional measures, for example to stimulate further energy efficiency in business, in the public sector and in households. Policies to raise the energy efficiency of products and buildings will have an important role. We will develop the present energy efficiency commitment, which requires electricity and gas suppliers to encourage their domestic customers to invest in energy efficiency measures such as cavity wall insulation. We will aim to bring forward to 2005 the next revision of the Building Regulations to raise standards for energy efficiency in new buildings and refurbishments. We will push in Europe for higher energy efficiency standards in tradeable goods such as fridges and personal computers. We will encourage improvements in efficiency and lower carbon fuels in transport. We will provide further encouragement for renewable energy and infrastructure investment through measures such as capital grants and a more supportive approach to planning. To this end, we are increasing the funding for renewables capital grants by £60 million, additional to the £38 million of extra funding announced in the 2002 Spending Review. And we will set an example throughout the public sector by improving energy efficiency in buildings and procurement.
- 1.32 Our second goal is to **maintain the reliability of our energy supplies**. This requires action on many fronts. We need the right infrastructure and regulatory system at home and liberalised energy markets within the European Union. We will also pursue closer international relationships to promote regional stability and economic reform in key producing areas, mutual understanding of the functioning of markets, and conditions for foreign direct investment to facilitate further infrastructure investment in the world's diverse gas and oil regions.
- 1.33 In liberalised markets, forward prices will send signals about the need for future investment. Suppliers will act on these signals, and on their own assessments of risk and opportunity, to innovate and plan to meet those needs. For example, in response to current market signals some companies are already planning to increase the amount of gas we can import through our existing pipeline to Belgium; others are exploring options for gas storage and new LNG importing facilities.
- 1.34 These developments help to provide reassurance that the market will invest in the capacity we need to provide reliable energy supplies - in particular to meet peak demand in exceptionally cold weather. Our market is not like the market in California in 2000, where overregulation undermined the ability of suppliers to respond effectively to market signals. However, a totally unregulated energy market would be unlikely to deliver sufficient security. So the Secretary of State and the regulator - OFGEM⁹ - both have duties to ensure that reasonable demands for electricity and gas are met. These duties are in turn carried forward into a number of conditions in the licences held by generators, suppliers, electricity transmission and distribution operators and gas transporters. We look to OFGEM to enforce these conditions in a manner consistent with their duties. With OFGEM we will continue and expand our monitoring of energy security. We will also continue to improve our contingency planning and resilience in dealing with major incidents, including terrorism, which could affect critical energy infrastructure.

9 The Office of Gas and Electricity Markets.

1.35 Thirdly, we are determined to promote **competitive energy markets**, in the UK and beyond. This will help to raise the sustainable rate of economic growth and support our industrial and business competitiveness through reliable and affordable energy. Energy makes a significant contribution to the economy, and represents a key input into all other sectors. A competitive energy sector is therefore important to the whole economy's competitiveness and productivity. We need greater resource productivity in business so that our firms use energy more efficiently, reduce carbon dioxide emissions and cut costs at the same time. To do that we will encourage firms to innovate and minimise costs and to deliver better quality goods and services. We will continue our commitment to competitive energy markets and use market-based instruments to deliver our wider energy policy goals. And we will work with business to help them prepare for the low carbon economy of the future and to seize the opportunities that it provides. Through our new sector skills network we will work with the energy industry to develop the skills that industry needs.

1.36 Our final goal is to **ensure that every home is adequately and affordably heated**.

In 1996, 5½ million households had to spend more than 10% of their income on heating their homes adequately (the normal definition of fuel poverty). Already, falling prices and higher social security benefits have helped reduce this number to around 3 million.

1.37 And alongside our policies to cut poverty we also need to tackle the problem of old, poorly insulated, draughty homes, where much spending on energy is simply wasted. In 2001 our fuel poverty strategy set out policies to

end fuel poverty in vulnerable households in England by 2010. We further aim that as far as reasonably practical nobody in Britain should be living in fuel poverty by 2016-18. Grant schemes and the energy efficiency commitment are already improving homes through better insulation, more efficient heating systems and minimising draughts. Later this year we will review the results of these policies and decide what more needs to be done to achieve our fuel poverty objectives.

Innovation is fundamental...

1.38 Technological innovation will have a key part to play in underpinning all our goals and in delivering a low carbon economy cost-effectively. We will support research, development and innovation both to encourage the development of new, longer-term options (for example in respect of the hydrogen economy) and where necessary to enable emerging technologies (such as renewables and new energy efficiency technologies) to demonstrate their potential. A new national energy research centre will be established by the Research Councils, targeted at research and development in the appropriate physical, environmental and biological sciences and including social and economic studies. Through the EU we are strongly backing the international development of fusion power for electricity generation. We will promote the development of homes and communities that combine energy efficient technologies and renewable energy to reduce radically their demand for energy from the grid. More widely, we will encourage UK business to make the most of the opportunities presented both here and overseas by moves towards a low carbon economy.

1.39 In all of this we will work both through our own national programmes and through a range of international collaborations and multilateral programmes which will enable us to maximise the return on our participation. We will work actively with partners in the G8 and the EU to develop climate change technologies which will be of benefit not only in helping us meet our own carbon reduction ambitions but also in helping others, especially in the developing world, to meet theirs. Capacity building programmes in appropriate areas of science, engineering and technology will be increasingly important in this process.

Looking to the future...

1.40 It will be clear from this white paper that we believe we need to prepare for an energy system that is likely to be quite different from today. It will be for the market to develop and invest in this. But we need to set clear goals and a strategy within which the market has the confidence, ability and sense of long-term commitment to do so. This white paper sets the way forward. In particular it is based on the following key principles:

- energy investments are generally long-term. Energy companies, industry and business and domestic consumers need us to set clear goals and a strategy that supports them in making the long-term investments they need to make in energy efficiency and supply;
- the cheapest, cleanest and safest way of addressing all our goals is to use less energy. We have to improve energy efficiency far more in the next 20 years than in the last 20;

- because a well-designed, transparent and open energy market is the best way of achieving efficient outcomes, we will wherever possible use market instruments to achieve our goals. In particular, emissions trading will be at the centre of our energy markets from 2005 onwards;
- we will need to continue to use trading as well as other measures to reduce carbon, in particular for the millions of domestic and smaller business consumers not covered by trading, along with measures to drive up energy efficiency in homes, products and transport;
- the nationwide and local electricity grids, metering systems and regulatory arrangements that were created for a world of large-scale, centralised power stations will need restructuring over the next 20 years to support the emergence of far more renewables and small-scale, distributed electricity generation;
- the future energy system will require greater involvement from English regions and from local communities, complemented by a planning system that is more helpful to investment in infrastructure and new electricity generation, particularly renewables. Strong links with the Devolved Administrations, who are already fully engaged on a wide range of energy issues, will continue to be essential;
- diversity is the best way of protecting ourselves against interruptions of supply, sudden price rises, terrorism or other threats to reliability of supply. As the UK becomes a net importer of energy we will need many sources, many suppliers and many routes. International relations in Europe and worldwide will be increasingly important to achieving our overall energy aims;

- we will seek out the best ways to influence outcomes in line with the principles of better regulation, maximising use of market based and/or voluntary mechanisms, promoting regulations only where they are clearly necessary and well designed. Where regulation is required we will work to make sure it takes account of the impact on key stakeholders to minimise the burdens particularly on smaller and medium sized enterprises; and
- when designing new energy policies, we will consider their impact on all of our energy policy objectives, in line with our overall approach to sustainable development.

1.41 We have applied these principles throughout this white paper.

Working with others...

- 1.42 We will need to work with others to deliver the ambitious goals we have set in this white paper. We will depend on businesses, supported by the research community, to adapt and innovate to deliver a low carbon future. We will rely on local authorities and regional bodies, working with the private sector and voluntary groups, to help to deliver real change on the ground, reflecting the needs of their different communities.
- 1.43 Many policies in this white paper cover the UK as a whole. But significant aspects of energy policy in Northern Ireland, Scotland and Wales are the responsibility of the Devolved Administrations, so that decisions are made in the light of each country's particular circumstances. Where matters are devolved, the distinctions in responsibilities are made clear. We will be keen to work with

the Devolved Administrations to address the energy challenges that we face.

- 1.44 Many of the challenges are international in scope and will need to be addressed through international collaboration. Addressing climate change and securing access to energy requires concerted international effort. The innovation necessary to address the long-term challenge of shifting to a low carbon economy also requires greater international collaboration. We will ensure that our domestic energy strategy is fully consistent with our international energy strategy and other international Government objectives.

What sort of energy system might we envisage in 2020 and beyond?

- 1.45 A broad vision of the energy system of 2020 is described below. This is a scenario. It draws on several sources, including modelling work for the white paper, the DTI's Foresight programme and other scenarios. It does not in any way close off options for the future. Innovation will give us options that we cannot even imagine now. The scenario will need to be updated in the light of experience.

The energy system in 2020...

We envisage the energy system in 2020 being much **more diverse** than today. At its heart will be a much greater mix of energy, especially electricity sources and technologies, affecting both the **means of supply** and the **control and management of demand**. For example:

- Much of our energy will be **imported**, either from or through a single European market embracing more than 25 countries.
- The backbone of the electricity system will still be a market-based **grid**, balancing the supply of large power stations. But some of those large power stations will be **offshore marine** plants, including **wave, tidal** and **windfarms**. Generally smaller **onshore windfarms** will also be generating. The **market** will need to be able to handle intermittent generation by using **backup capacity** when weather conditions reduce or cut off these sources.
- There will be much more **local** generation, in part from medium to small local/**community** power plant, fuelled by locally grown **biomass**, from locally generated **waste**, from local **wind sources**, or possibly from local **wave and tidal** generators. These will feed local **distributed networks**, which can **sell excess capacity** into the grid. Plant will also increasingly generate **heat** for local use.

- There will be much more **micro-generation**, for example from **CHP** plant, **fuel cells** in buildings, or **photovoltaics**. This will also generate excess capacity from time to time, which will be sold back into the local distributed network.
- **Energy efficiency** improvements will reduce demand overall, despite **new demand** for electricity, for example as homes move to digital television and as computers further penetrate the domestic market. Air conditioning may become more widespread.
- New homes will be designed to need very little energy and will perhaps even achieve **zero carbon emissions**. The existing building stock will increasingly adopt energy efficiency measures. Many buildings will have the capacity at least to **reduce their demand** on the grid, for example by using **solar** heating systems to provide some of their water heating needs, if not to generate electricity to sell back into the local network.
- **Gas** will form a large part of the energy mix as the savings from more efficient boiler technologies are offset by demand for gas for CHP (which in turn displaces electricity demand).
- **Coal fired generation** will either play a smaller part than today in the energy mix or be linked to **CO₂ capture and storage** (if that proves technically, environmentally and economically feasible).

A strategy for the long term...

- 1.46 In this white paper we set out a long-term framework to deliver our environmental, security of supply, competitiveness and social goals. Because energy requires very long-term investment we look ahead to 2050 to set the

overall context. We review what we will need to have achieved by 2020 if we are to be confident we are moving in the right direction, fast enough, to deliver our aims for 2050.

- The existing fleet of **nuclear** power stations will almost all have reached the end of their working lives. If new nuclear power plant is needed to help meet the UK's carbon aims, this will be subject to later decision.
- **Fuel cells** will be playing a greater part in the economy, initially in static form in industry or as a means of storing energy, for example to back up intermittent renewables, but increasingly in transport. The **hydrogen** will be generated primarily by non-carbon electricity.
- In **transport**, hybrid (internal combustion/electric) vehicles will be commonplace in the car and light goods sectors, delivering significant efficiency savings. There will be substantial and increasing use of **low carbon biofuels**. Hydrogen will be increasingly fuelling the public service vehicle fleet (for example buses) and utility vehicles. It could also be breaking into the car market.
- **Nuclear fusion** will be at an advanced stage of research and development.
- People generally will be much more aware of the **challenge of climate change** and of the part they can play in **reducing carbon emissions**. Carbon content will increasingly become a commercial differentiator as the cost of carbon is reflected in prices and people choose lower carbon options.

1.47 This white paper seeks to define a long-term strategic vision for energy policy. We set out long-term strategies and, against that background, shorter-term policies to put us on the path we need to be on. In particular, renewables and energy efficiency are and will remain high priorities. We do not, however,

seek to define every detail of the policies we need to pursue over the next twenty years and beyond. That would simply not be realistic. We need to be prepared, within a firm and clear strategic context, to review the impact of policy changes and to update and amend our detailed policy measures in the light of experience. We believe, for example, that technological innovation will have an important contribution to make in helping to deliver our long term vision.

This will bring new opportunities and possibly new challenges that we cannot imagine now. We have to be prepared to adapt and evolve our policies in the light of those opportunities and wider changes in society.

1.48 In recognition of this, we set out at the end of this white paper arrangements for strengthening our capabilities in the field of energy policy. These new arrangements will include annual public reports both on progress towards the aims we set out in this white paper and the steps we are taking to ensure we remain on track. This will not be the last major strategic statement on energy policy. But it sets a new direction, and a new determination, to deliver very significant changes in both the short and longer terms. It is a massive challenge. But it is one that has to be met. And one we believe we can meet.

Inputs to the white paper...

Many of the policies set out in this white paper take as their starting point the Energy Review published by the Cabinet Office's Performance and Innovation Unit (now the Strategy Unit) in February 2002. In publishing the review, the Prime Minister said that he wanted to launch a thorough debate on the issues it raised. In February 2002 the Trade and Industry Committee published a report on Security of Energy Supply and the House of Lords Select Committee on the European Union published a report on European energy issues (*Energy Supply: how secure are we?*). The Committees' recommendations have been taken into account in drawing together our conclusions in this white paper.

Following the PIU report, we launched a major stakeholder and public consultation in May 2002. This:

- stimulated a wide range of workshops, meetings, conferences and seminars, some run by stakeholders, some run by Government departments and other public bodies;
- prompted over 2500 written submissions to the team working on the white paper;
- launched a wide-reaching and innovative public consultation process commissioned by the DTI, involving focus groups, deliberative workshops, outreach to school students and a web-based questionnaire; and
- provided the basis of a web-based stakeholder debate.

In total over 6500 individuals and groups have had input to the consultation. This represents the most significant consultation on energy policy ever undertaken in the UK. It has provided an immensely rich source of views and information to help guide the development of policy options. We are very grateful to all those who participated in the consultation.¹⁰ In the future, outreach to stakeholders and the wider public will continue to be an important part of the follow up to the white paper.

1.49 This white paper is based on a large amount of analysis and modelling. We are publishing separately documents which form part of that work, on estimates of the cost and potential for various long term low carbon options; on the background outlook for energy demand and emissions between 2000 and 2050; an initial assessment of the impact of the policies as set out in this white paper; and background calculations to achieving carbon cuts of between 15-25 million tonnes of carbon in 2020.¹¹

10 Most of the material submitted to the white paper team can be found on the DTI's website at www.dti.gov.uk/energy/developpep, except where those submitting information asked for it not to be made publicly available. The website also includes reports on meetings held during the consultation.

11 This work is available at www.dti.gov.uk/energy/whitepaper/



Section Two

The Low Carbon Economy

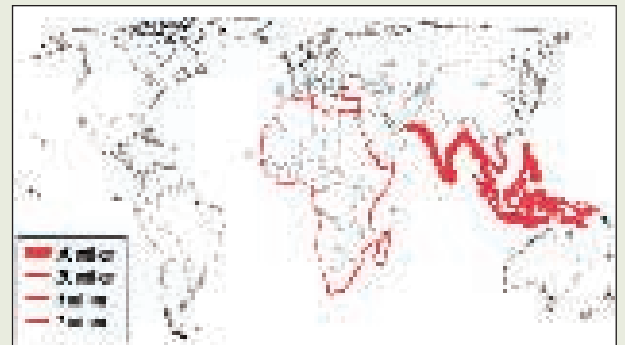
Chapter 2 The Environment

Climate change is happening...

- 2.1 There is now strong scientific evidence that climate change is happening and that it is being accelerated by human activity. The world is getting warmer. The earth's temperature rose by 0.6°C during the last century and is forecast to rise by between 1.4 and 5.8°C during this century. Globally the 1990s was the warmest decade and 2002 the second warmest year since records began.
- 2.2 There is increasing evidence that this is the result of an increase in atmospheric concentrations of greenhouse gases - notably carbon dioxide released by burning fossil fuels such as coal, oil and gas. By absorbing heat these gases keep the earth's temperature warmer than it otherwise would be. As greenhouse gas concentrations rise well above their natural levels, the additional warming that will occur could threaten human society.
- 2.3 Climate change research has looked at how far changes in temperature over the past century are due to human activities. Natural effects, such as variations in the sun's output and volcanoes, are insufficient to account for the observed warming, which can only be explained by greenhouse gases from human activities.
- 2.4 The rate at which the climate is changing will affect the world in extreme and unpredictable ways. Its impacts could include:
 - many millions more people being exposed to the risks of hunger, water stress, flooding and diseases like malaria. Poor people in developing countries are likely to be most vulnerable;

- low-lying areas, wetlands and small islands will be especially at risk from sea-level rise. Globally, an extra 80 million people could be exposed to flood risk by the 2080s, 60% of whom are likely to be in the poorest parts of South East Asia. In one of the most vulnerable areas, Bangladesh, a 45cm rise in sea level could result in 10% of the total land area being lost and 5½ million people being put at risk;

Chart 2.1
Number of additional people at risk of flooding each year by the 2080s, assuming no action to cut green house gas emissions¹



- irreversible losses of biodiversity could be accelerated. Expected impacts include bleaching of coral reefs, loss of mangrove swamps and impacts on fish populations. Changes in the polar regions are expected to be the largest and most rapid, leading to thawing of permafrost, melting of ice sheets and changes in species distribution; and
- the UK will also be affected. Rising sea levels could threaten our coastal communities and environment. Storms and extreme events could have the most costly impacts - the autumn 2000 floods cost the UK £1bn.

1 Source: Defra

The costs of climate change

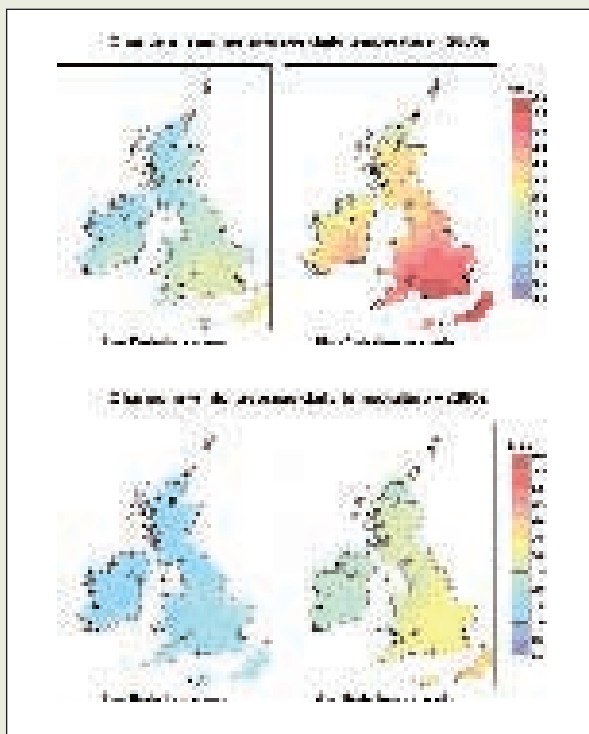
A Government Economic Service working paper² has suggested £70/tC (within a range of £35 to £140/tC) as an illustrative estimate for the damage cost of carbon emissions. It also suggested that this figure should be raised in real terms by £1/tC per year as the costs of climate change are likely to increase over time.

These values are under review in light of developments in the academic literature and in the Government's economic appraisal guidance. Currently the estimate only represents a subset of damage costs, and the review will also consider issues of coverage. While the suggested range covers impacts such as effects on agriculture, wildlife and health, sea level rise and some extreme weather effects, it does not include the possible impacts of 'climate catastrophes' (e.g. melting of the West Antarctic ice sheet or

changes to the Gulf Stream), of social impacts such as famine or mass migration, or of impacts after 2100. Nor does it include other benefits of reducing emissions, such as improved air quality. These could increase the social cost of carbon considerably. Impacts will also vary significantly across sectors and regions.

These values do not set a limit on the acceptable costs of reducing emissions. Wider impacts on other energy policy objectives are also relevant. Costs which initially look high may also be reduced by economies of scale and innovation. Nevertheless, in looking at measures to reduce carbon it is important to consider abatement costs. Most of the carbon savings we are looking at pre-2020 can, we believe, be delivered at costs lower than, or in line with, the illustrative range for damage costs.

Chart 2.2
Changes in summer and winter temperatures³



2.5 We will have to adapt to some degree of climate change. Greenhouse gases that have already built up in the atmosphere mean that some temperature rise is inevitable. In the UK, we are already taking steps to adapt the way we manage flood risk, water and other natural resources, but there is still more to do, and there will be challenges for the transport, construction and business sectors too. For developing countries, climate change increases the urgency of finding more sustainable pathways to development.

² *Estimating the Social Cost of Carbon Emissions*, Government Economic Service Working Paper 140, www.hm-treasury.gov.uk

³ Changes in average summer and winter temperatures (with respect to Hadley Centre model - simulated 1961-1990 baseline climate) for a 30-year period centred on 2080 for high and low greenhouse gas emissions scenarios. UK *Climate Impacts Programme*, 2002.

Action to limit emissions is under way...

- 2.6 But the worst effects of climate change can be avoided if concentrations of greenhouse gases in the atmosphere are stabilised, rather than increasing as they are now. There is as yet no international consensus on the level at which concentrations of greenhouse gases should be stabilised. But in 1997 the EU member states agreed that we should be aiming for a global average temperature increase of no more than 2°C above the pre-industrial level and therefore a concentration below 550 parts per million (ppm) of carbon dioxide - about twice the pre-industrial concentration - to prevent the most damaging effects of climate change.
- 2.7 Even at this level, there will be negative impacts⁴. The majority of the world's population is likely to experience some consequences. At the upper end of the possible temperature rises there would be severe impacts on natural systems and on all sectors of society, a significant increase in extreme climatic events and a high risk of major geographical changes in ice sheets or in ocean currents. Higher concentrations would be likely to pose even greater and more unpredictable risks.
- 2.8. Against this background we take the view that the potential consequences of climate change are so severe that, within a policy framework that keeps costs to a minimum, we should take steps ourselves and work closely with other countries to reduce our greenhouse gas emissions. If we are to stabilise carbon dioxide concentrations in

the atmosphere at no more than 550ppm, global emissions will need to drop well below current levels.

- 2.9 Already policy-makers around the world have begun to respond to these challenges. The UN Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol are the starting point for international efforts to cut emissions.

The UN Framework Convention on Climate Change and Kyoto Protocol

The UNFCCC aims to prevent dangerous man-made climate change and commits developed countries to taking the lead in tackling climate change. The Kyoto Protocol set legal targets for them to reduce greenhouse gas emissions by around 5% of 1990 levels in the period 2008-2012. The US and Australia have withdrawn from the Protocol, though Australia has said that it still intends to limit its emissions as if it had decided to ratify. It seems likely that the effect of the Protocol in the period 2008-2012 will be a reduction in projected global emissions of at best 2%. To help meet targets, countries can use international emissions trading or receive credits for reductions achieved by supporting projects in other countries. Discussions on action beyond 2008-12 must begin by 2005. In the long term, developing countries are most at risk from climate change and need to be helped to become a part of the global response to it. Developing countries currently account for around 40% of global CO₂ emissions from fossil fuels, and their emissions may exceed those of developed countries by 2020, although per capita emissions in most developing countries are still relatively low.

⁴ Based on conclusions of the *Third Assessment Report of the Intergovernmental Panel on Climate Change, 2001*.

But more needs to be done...

2.10 Climate change is a global problem. It has to be tackled globally. The UK will continue to show leadership but it cannot solve this problem alone. The UNFCCC and its Kyoto Protocol demonstrate that it is possible to reach global agreement on action, but far more needs to be done. UK emissions of carbon dioxide currently account for only about 2% of the global total. Our own actions will have no impact on climate change unless they are part of a concerted international effort. A wider effort is also necessary, for example in bringing forward technological changes, to keep down costs to the UK and to avoid compromising our competitiveness.

We will therefore continue to work with other countries to establish both a consensus around the need for change and firm commitments to take action to reduce carbon emissions world-wide within the framework of the UNFCCC.

2.11 Some countries, including some of our European partners, are already moving in this direction. We need, with them, to lead others internationally. It is clear that substantial cuts are needed in the longer term. Delay will only compound the problem. We therefore believe that the time is now right to reinforce our commitment to the achievement of significant long-term cuts in emissions in the UK.

2.12 Our ambition is for the world's developed economies to cut emissions of greenhouse gases by 60% by around 2050. **We therefore accept the RCEP's recommendation that the UK should put itself on a path to a reduction in carbon dioxide emissions of some 60% from current levels by about 2050⁵.** In this white paper, we therefore set out the first steps to achieving this goal.

And we set as a key objective of the UK's foreign policy securing international commitment to this ambition.

2.13 We can get to a 60% cut in emissions by 2050 in a number of ways. But leaving action until the last minute is not a serious option. If we do not begin now, more dramatic and more disruptive change will be needed later on. We need early, well-planned action to provide a framework within which businesses and the economy generally can adjust to the need for change. This will for example allow business to plan to act in the course of normal capital replacement cycles. It will also encourage new technologies to come forward to meet the challenges we face.

2.14 The UK already has a Kyoto Protocol commitment to reduce greenhouse gas emissions by 12.5% below 1990 levels by 2008-12 and a national goal to move towards a 20% reduction in carbon dioxide emissions below 1990 levels by 2010. The measures in this white paper keep us on track for both goals⁶, and represent a significant departure from the level that emissions would otherwise be under 'business as usual'.

5 A reduction in carbon dioxide emissions of 60% by 2050 is consistent with the level of reduction likely to be needed by developed countries in order to move towards stabilisation of carbon dioxide concentrations in the atmosphere at no more than 550 ppm, taking account of a realistic assessment of emissions growth in developing countries. This is set out in more detail in the Defra paper *The scientific case for setting a long term emission reduction target*, available at www.defra.gov.uk/environment/climatechange. RCEP's recommendation of putting the UK on a path to 'reducing carbon dioxide emissions by some 60% from current levels by about 2050' was based on a more detailed calculation of 58% reductions from 1997 levels. This would lead to 2050 emissions of 64 MtC. The Kyoto Protocol, and the UK's current domestic targets, use 1990 as a baseline. A precise reduction of 60% in emissions from 1990 would result in emissions of 65.8 MtC in 2050. As the RCEP recommendation implies, absolute precision five decades before 2050 is not possible. This white paper uses 'around 65 million tonnes' to describe the level of carbon emissions which a 60% cut would deliver by 2050.

6 The UK's carbon dioxide emissions increased for the second year running in 2001 and were some 5.2% below the 1990 level, having been 8.1% below in 1999 and 7.3% below in 2000. This upward trend is expected to have been reversed in 2002 when emissions are likely to have decreased slightly. The measures in this white paper should allow the domestic goal to be achieved. We are also committed to reviewing the Climate Change Programme in 2004. This will provide an opportunity to review progress and to strengthen measures if it is thought necessary to keep us on track towards the domestic goal.

2.15 Discussions under the UNFCCC to tackle climate change beyond 2008-12 will start soon. On the basis of our current policies, including the full impact of the Climate Change Programme, our carbon dioxide emissions might amount to some 135 MtC in 2020⁷. To be consistent with demonstrating leadership in the international process, we will aim for cuts in carbon of 15-25 MtC below that by 2020. This would also put us on course to reduce our carbon dioxide emissions by some 60% by about 2050.

2.16 If we are to cut emissions this much we will need to achieve a fundamental long-term shift in the way energy is supplied and used. Already we have decoupled economic growth from energy use and carbon emissions. Overall energy consumption in the UK has risen by around 15% since 1970, while the economy has doubled.

2.17 In order to achieve our aims we must accelerate this trend. If the UK economy were to grow at an average of 2.25% a year between now and 2050 it would be three times as large then as it is now. Reducing carbon emissions to around 65MtC (see footnote 5) in the same period would require an improvement in the ratio between emissions and economic output of around seven-fold. We will achieve this by raising the resource productivity of our economy - producing more with less pollution.

2.18 The table below illustrates how cuts of 15-25 MtC could be achieved by 2020. The exact target figure will be determined in the light of international negotiations, and the actual mix of measures needed to reach it will be shaped by economic and technological developments. **We will put in hand measures now to ensure we are well placed to deliver on our commitments.**

Chart 2.1
GDP, primary energy consumption and emissions

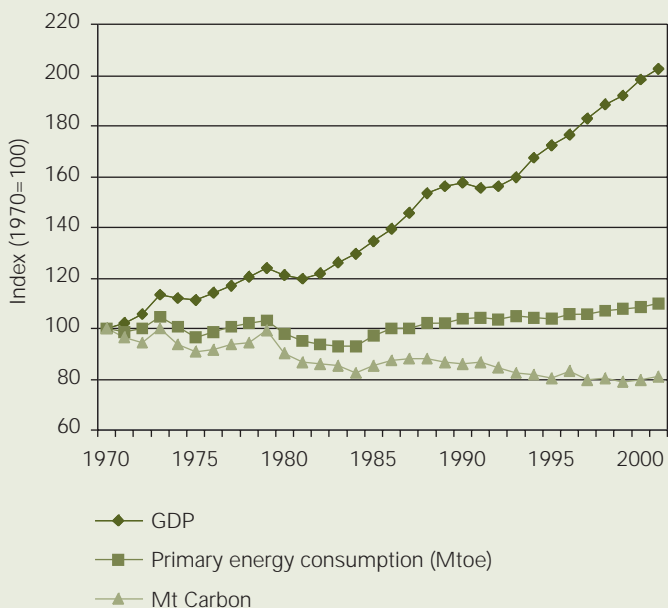


Table 2.1
How cuts of 15-25MtC could be achieved by 2020

	Estimated MtC reductions ⁸
Energy efficiency in households	4-6
Energy efficiency in industry, commerce and the public sector	4-6
Transport: continuing voluntary agreements on vehicles; use of biofuels for road transport	2-4
Increasing renewables	3-5
EU carbon trading scheme	2-4

7 See material referred to in paragraph 1.49.

8 The figures represent reductions below the baseline of 135 MtC discussed in paragraph 2.15.

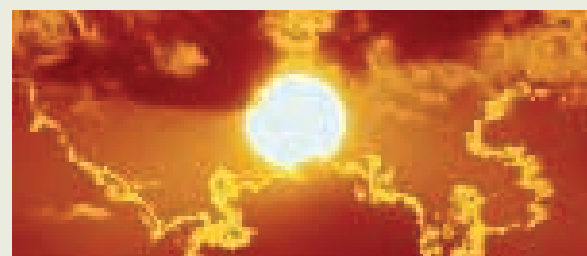
2.19 The Kyoto Protocol's project mechanisms provide for credits from international emissions trading, including from projects under the Clean Development Mechanism and Joint Implementation, to contribute towards emission reduction commitments. They will provide another possible route to savings, although it is not yet possible to judge the scale of any contribution that they may make.

Maintaining our competitiveness at the same time...

2.20 We have analysed carefully the likely impacts on the UK economy of cutting emissions by 60% by 2050. A good deal of caution is needed in looking at economic changes over such a long period and given the sensitivity to the assumptions made. But analysis of data assessed by the Intergovernmental Panel on Climate Change suggests that action aimed at stabilising carbon dioxide atmospheric concentrations at no more than 550ppm would lead to a loss of around 1% in projected GDP⁹. The outcome of our UK analysis is consistent with that review, assuming that the world's leading nations all act together. It suggests that the cost impact of effectively tackling climate change would be very small - equivalent in 2050 to just a small fraction (0.5 - 2%) of the nation's wealth, as measured by GDP, which by then will have tripled as compared to now. And this figure takes no account of the costs avoided by tackling climate change.

2.21 Modelling work shows that higher transition costs would occur if there were very tight reduction targets in too short a time scale, if policies such as emissions trading or other economic instruments were not used or if energy efficiency was not exploited. In the medium term, transition costs would also increase if other countries did not take action to reduce emissions. But the more other countries commit to move in the same direction, the less direct impact there will be on the UK. These impacts need to be monitored and managed, both across the economy and sector by sector. And there will also be some economic benefits, for example through increasing energy efficiency or through enabling UK firms to benefit from new opportunities in manufacturing, servicing and exporting lower-carbon and renewable energy technologies. **We will ensure that we continue to work closely with businesses to develop strategies to enable them to adapt to these changes and exploit them as appropriate.**

⁹ Report of Working Group III of Intergovernmental Panel in Climate Change, Mitigation, 2001.



Analysis and modelling work

A wide range of analytical work has supported the white paper. This included work by the Government's interdepartmental analysts group on long-term reductions in greenhouse gas emissions, following which the DTI commissioned Future Energy Solutions to use the MARKAL modelling approach to look at the costs and options for a substantial CO₂ reduction by 2050¹⁰. MARKAL uses a 'bottom-up' model of the UK energy system, which selects the least cost technologies to meet specified energy demands, subject to constraints imposed on emissions.

The results depend on the assumptions - on technology availability and costs - that are made in the model. However, the assumptions used reflected expert opinion, informed by workshops with industry experts.

The work was not intended to create a single view or forecast. Instead a wide range of sensitivity analyses was carried out to assess which technologies and measures might be crucial to minimising the costs of emissions

reduction and to assess how costs change if assumptions are varied. The analyses covered business as usual cases as well as reductions in CO₂ of 45%, 60% and 70% by 2050.

The analysis suggests that for many of the assumptions tested the cost of reducing CO₂ emissions by 60% by 2050 was in the range £200-300 per tonne of carbon. GDP in 2050 was reduced by 0.5-2.0%, equivalent to an average annual reduction of between 0.01 and 0.02 percentage points from a business as usual GDP growth rate of 2.25% per annum.

Higher costs were indicated if innovation in low-carbon technologies was limited, if energy efficiency improved only in line with past trends, or if both new nuclear build and carbon capture and storage were completely excluded in the longer term.

To be on track for the 15-25 MtC reduction beyond current baselines that we are aiming at, MARKAL indicates costs of reducing carbon in 2020 in the range £10-80 per tonne of carbon.

A clear long-term policy framework...

2.22 To deliver these outcomes, our aim will be to provide industry and investors with a clear and stable policy framework. In practice, we need a mix of measures in order to shape the market to achieve our goals, including economic instruments and regulation. But we are seeking a framework which, as far as possible, simplifies the mix of measures and takes account of the cost of environmental damage from carbon emissions. We will also

aim to use the price mechanism as far as we can to give clear signals about these costs. This will give the market the flexibility to determine the best way to reduce carbon emissions, and drive action on both the demand and supply sides of the economy. It will also give business a dynamic incentive to find new and innovative ways to reduce emissions. Environmental taxes and tradable permit schemes can both help to achieve these objectives.

2.23 The UK has already made significant progress through the climate change levy and the voluntary UK emissions trading scheme.

¹⁰ Full details of this work are at www.dti.gov.uk/energy/greenhousegas/index.shtml

The levy is a tax which applies to business and public sector use of gas, coal, electricity and liquefied petroleum gas (LPG). It gives those sectors an incentive to improve energy efficiency and thereby to reduce greenhouse gas emissions. It also involves 80% discounts for energy-intensive sectors which enter into climate change agreements to improve energy efficiency or meet emissions targets. Following the recommendations of Lord Marshall, the levy was designed as a 'downstream' energy tax,¹¹ which makes it possible to avoid impacting on domestic energy users, and therefore avoid adding to the problem of fuel poverty.

2.24 The first phase of the UK emissions trading scheme has involved a range of organisations from the private and public sectors agreeing to meet emissions caps in return for a share of a financial incentive. Emissions trading has expanded recently through the participation of firms covered by climate change agreements, seeking to deliver their targets.

2.25 The development of emissions trading in the next few years will primarily be dependent on developments at EU level. On 9 December 2002, the European Union Council of Ministers reached initial agreement on a new European carbon emissions trading scheme. This is expected to begin in 2005.¹² Installations which are covered by other equivalent arrangements may not need to join the scheme until 2008. In the scheme, each participant will be set a cap - a target level of emissions. Each will then receive

tradable allowances equal to its cap. To comply with the scheme, each participant must hold allowances at least equal to its emissions. Participants will therefore have three choices:

- meet their cap by reducing their own emissions;
- reduce emissions below their cap and sell or bank the excess allowances; or
- let their emissions remain above their cap and buy allowances from other participants.

2.26 The best strategy for each participant will depend on the price of allowances in the market compared to the costs of reducing their own emissions. In this way, emission reductions from the participating sectors will be achieved at minimum cost across the European Union.

2.27 **We will make the new trading scheme a central plank of our future emissions reduction policies, through which the traded carbon market can set a signal for the value of carbon reductions in the economy. It will be a mechanism for delivering part of the carbon savings we need to make, helping to save around a further 2-4MtC by 2020. We will continue to work proactively with the European Commission, European Parliament and other member states to secure detailed plans for the implementation of the scheme to help deliver this aim. We will also work with them to extend, where appropriate, the coverage of the EU scheme in due course.**

2.28 The inclusion of the electricity industry within the scope of the EU emissions trading scheme will further change the incentives on electricity generators and suppliers, as it will begin to give a direct incentive to electricity

11 In report *Economic Instruments and the Business Use of Energy*, November 1998 <http://archive.treasury.gov.uk/pub/html/prebudgetNOV98/marshall.pdf>

12 From the outset, it is proposed that it should cover CO₂ emissions from combustion installations exceeding 20MW, oil refineries, coke ovens, and ferrous metal industries, mineral industries and pulp and paper plants (over certain size thresholds).

generators to reduce emissions. To the extent that the scheme leads to an increase in electricity prices, this will add to costs for electricity users. The scale of such impacts is currently uncertain, but will be driven by the price of carbon in the European market.

2.29 We aim to have a coherent approach to carbon valuation and energy use, so that environmental costs can be internalised as efficiently as possible, irrespective of whether the instruments are international or domestic. The linkages between tax and tradable permit schemes will be carefully considered in the light of the emerging EU emissions trading scheme. As the box below shows, emissions trading is unlikely to cover all emissions from all sectors of business for the foreseeable future, and there will continue to be a role for a tax if a price signal is to be given to other areas of business.

2.30 The issues involved in linking the two mechanisms are not entirely new. The UK has already made links between the sectors covered by the climate change agreements and the voluntary emissions trading scheme. Some changes might be needed, for example, to ensure that the sectors of manufacturing industry which are covered by the EU emissions trading scheme are not subject to unnecessary burdens. The views of manufacturers would be welcome. We will now consider the impact of the proposed EU emissions trading scheme on the climate change levy, while bearing in mind that this will ultimately depend on the precise nature of the future emissions trading scheme which has yet to be agreed. Any tax changes will be a matter for future Budgets.

Emissions trading - potential development

The political agreement on the proposed EU trading scheme outlines its design, together with procedures for expansion. How the scheme will develop in the UK will depend on further work on proposals to manage the transition from the current UK policy mix to the new EU scheme, as well as on decisions by the European Commission and member states. But a possible scenario might be:

January 2005 - First phase of the EU scheme starts, covering CO₂ from electricity generation, oil refineries and some other sectors of heavy industry. Temporary exclusions allowed for heavy industry during this first phase, with caps on generator emissions adjusted to take account of measures for renewables and energy efficiency.

January 2007 - Current phase of UK emissions trading scheme for 'direct participants' ends. All of the direct participants in the UK scheme that are covered by the EU scheme transfer their CO₂ emissions to the EU scheme.

January 2008 - Second phase of EU scheme starts. Scheme covers CO₂ emissions from other sectors of industry as required by the directive and relevant changes made as necessary to the arrangements for the climate change agreements.

Coverage could be extended by unilaterally opting in other activities and greenhouse gases, or by harmonised EU-wide expansion. The EU scheme might expand to include other energy intensive sectors of industry or other industrial and commercial sectors where the size of installation makes this cost-effective.

2.31 The European Union is also close to agreeing a directive on the taxation of energy products. This would require all member states to introduce taxes on the business use of energy to encourage energy efficiency, such as the climate change levy. Once agreement on the emissions trading directive has been reached, the Commission is planning to bring forward proposals to modify the rules on taxation of energy products in the light of the agreement on community-wide emissions trading, to ensure that the two schemes are complementary. We will consider these proposals as part of our own approach to linking the two measures.

2.32 Wherever possible, we will also link the other measures described in this white paper to the carbon emissions trading scheme. This will help enable a common Europe-wide value to emerge for carbon savings, enabling business and consumers to choose themselves how best to achieve their economic and commercial aims against that background. We will now be taking forward work to consider how best to make such linkages and will come forward with appropriate proposals when the relevant policy positions are more firmly established.

also has binding international commitments to meet targets for emissions of air pollution and for local and regional air quality, including cuts of 50% in sulphur dioxide and 20% in oxides of nitrogen from current levels by 2010. Meeting these will require significant reductions in emissions from electricity generation, in particular current coal fired generation. Energy infrastructure, including renewable energy, has effects on the environment. Future analysis of energy policy choices will continue to bear all these impacts in mind.

Considering other environmental impacts too...

2.33 There are other important environmental issues to be borne in mind as well as climate change. Measures to reduce carbon emissions can also have other benefits, such as improved air quality.¹³ For example, the UK

¹³ Air quality is set out in *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Cm4548, January 2000. www.defra.gov.uk/environment/airquality

Chapter 3 Energy Efficiency

3.1 Over the last thirty years, our economy has doubled in size, while energy use has barely increased¹. Nonetheless, we are still using far more energy than we need, in particular because we are using it inefficiently. Energy is often wasted because of poorly insulated buildings or where heating, ventilation, air conditioning and lighting are poorly controlled. Products are less energy efficient than they could be - for example, the average upright freezer on the market today uses nearly three times as much energy as the most efficient one. Energy saving light bulbs² use less than a quarter of the energy of ordinary light bulbs, and also last ten times longer. Businesses and householders may not know how to cut energy use, which is just one of many demands on their time and capital.

3.2 The cheapest, cleanest and safest way of addressing our energy policy objectives is to use less energy. The financial benefits of doing so are clear. Better insulated buildings and more energy efficient workplaces cut energy bills for householders and businesses. Reducing demand puts less pressure on energy supplies.

3.3 Over the last 30 years the economy's energy intensity³ - the ratio of energy consumption to GDP - has improved by around 1.8% each year. Without this, home heating, for example, would use more than twice the energy it uses today. But simply continuing previous rates of change is not enough. We have to improve energy efficiency far more in the next twenty years than in the last twenty if we are to meet our goals. Many other industrialised countries already do far better than the UK.

Chart 3.1
Energy intensity ratio in "top 20" OECD countries, 2000⁴



3.4 This chapter sets out how we will achieve the necessary step change in energy efficiency across our economy. Our policies have to tackle barriers to the uptake of energy efficiency across all energy users, and provide the framework for continuing, and accelerating, the rate of improvement in the UK's energy intensity. We must also promote innovation to find new ways to save energy in the future.

The savings we need...

3.5 We expect more than half the emissions reductions in our existing Climate Change Programme - around 10 MtC per annum by 2010 - to come from energy efficiency.

1 See paragraph 2.16

2 Compact fluorescent lamps (CFLs)

3 Energy intensity for the UK as a whole is total energy consumption divided by total GDP. It is normally expressed as Mtoe/\$USbn, to enable international comparison.

4 Source: IEA

Energy efficiency savings to 2010⁵

Households account for around 5MtC of the expected savings. We have put in place measures to deliver 1.5 MtC, and this white paper sets out key measures which have the potential to deliver the remaining 3.5 MtC. The following are not targets for individual items, but illustrate where savings might be achieved:

- progressively raising efficiency standards to that of the most efficient boiler type, condensing boilers, and installing around 5 million, saving around 0.6MtC;
- insulating around 4.5 million cavity walls from 2005-2010, saving around 1.2 MtC;
- installing an extra 100 million energy saving lights, beyond the 60 million already anticipated by 2005, saving around 0.5MtC;
- faster improvements in the standards of new household appliances and significantly increasing the uptake of A-rated appliances, which could save around 0.4MtC; and
- other insulation measures, improved heating controls, improved standards of new build and refurbishment through revisions to the building regulations, and community heating with CHP, saving around 1MtC.

The Climate Change Programme anticipates savings of around 6MtC by 2010 from **businesses and the public sector**. The climate change levy, the associated climate change agreements, and the UK's own voluntary emissions trading scheme already put us on track to deliver these savings.

- 3.6 Further ahead, **we believe that energy efficiency can contribute around half of the additional 15-25 MtC savings we are likely to need by 2020** (see chapter 2 table 2.1).

⁵ These savings are already anticipated in the 135 MtC baseline emissions to 2020 explained in chapter 2.

- **by 2020, a further 4-6MtC of annual savings can come from households.**

This will require further uptake and development of insulation, including in homes that current technologies cannot tackle cost effectively, such as the 7 million homes with solid walls. Building standards, heating systems, lighting and appliances must continue to improve, in some cases through technologies yet to reach the market, such as LED⁶ lighting. We will need more innovative developments, which combine energy efficiency with measures such as micro CHP, small-scale renewable heat such as solar water heating, or renewable power such as solar electricity; and

- **by 2020, a further 4-6 MtC can be delivered annually from the business and public sectors.** The source of savings, and the types of policy to encourage them, would build on those to 2010, with progressively tighter emissions caps under the EU emissions trading scheme being a key measure to stimulate further savings.

- 3.7 Savings of this magnitude would need roughly a doubling of the rate of energy efficiency improvement seen in the past thirty years.

Delivering the savings...

- 3.8 To deliver these savings, we need a mixture of measures, addressing key areas of our economy - including energy used for heating, lighting and powering buildings and appliances in them, which accounts for around half of the UK's total energy consumption. Different policy instruments - emissions trading, the energy efficiency commitment, tax incentives, a greater

⁶ Light emitting diodes

emphasis on energy services, building and product regulations, advice and information - will be designed to reinforce each other.

- 3.9 As chapter 2 explains, the new EU emissions trading scheme will play a central role from 2005. By setting strict limits on carbon emissions, it will spur large energy users to find cost-effective ways to reduce emissions. We will press for the scheme to develop so that other sectors can be added or linked to it wherever possible. **The energy efficiency commitment (see paragraph 3.32) will have a major role to play in homes, and we will consider whether to extend it beyond the household sector.** Higher efficiency standards for products and buildings will be required.
- 3.10 Tax measures will also have a role to play. Lower taxation on lead-free petrol helped to shift consumer demand to the point where leaded petrol was phased out. The Chancellor announced in the 2002 Pre-Budget Report that we would consult further on specific measures to promote greater energy efficiency in households.

Through higher building standards...

- 3.11 Compared with the 1990 building regulations, the latest revisions introduced last year have reduced the energy needed for heating a new home by half. Similar improvements have been achieved in new commercial and public sector buildings. In the existing stock, which will continue to account for the vast majority of energy consumed in buildings for decades to come, regulations also cover major changes - for instance, higher standards for replacement boilers and windows in England and Wales were

introduced in April 2002. Similarly in Scotland, higher standards were introduced in March 2002, including for replacement windows, and the Building Bill will be enacted in 2003 with the aim of further improving standards.

- 3.12 But standards elsewhere remain higher, particularly in Northern Europe. A detached house built to the latest standards in England and Wales consumes nearly 20% more energy than an equivalent home in Denmark⁷. **We will raise standards over the next decade, learning lessons from the standards achieved in other comparable European countries.**
- 3.13 **We will also use the regulations further to raise the standard required for new and replacement boilers to the level of the most efficient boiler types - A and B rated condensing boilers.** Over 1 million boilers, heating and hot water systems are replaced each year, and we believe around 5 million condensing boilers need to be installed by 2010. Currently, our performance falls well short of what has been done elsewhere, as the table below illustrates.



⁷ *Putting Climate Change at the Heart of Energy Policy*; EST submission to the energy white paper, 2002 (www.est.org.uk/est/index.html)

Condensing boilers - a case study⁸

The Netherlands

1980-1987: Subsidies for condensing boilers and a widespread information campaign.

Mid 1980s: Demand outstripped supply so manufacturers launched intensive installer training programmes.

1990: Subsidies relaunched: government funding matched by funding from energy companies through a customer levy. Housing policy promoted condensing boilers.

1995: Building regulations require new build to meet standards of energy efficiency only achievable with condensing boilers.

1996: Long term awareness campaign started, plus energy efficiency labelling.

1996: Energy tax introduced with hypothecated revenue for energy efficiency.

2000: Subsidies (25%) for energy audits introduced.

2002: Condensing boilers account for ~75% of Dutch market.

UK

1980s: Development and demonstration of technology under the Government's Energy Efficiency Demonstration Scheme.

1989-today: Promotion under the Government's Energy Efficiency Best Practice Programme.

1993-4: British Gas-funded cashback scheme.

1996-9: Government-funded cashback schemes.

1997 onwards: 'Energy Efficiency'⁹ awareness-raising campaign with labelling of condensing boilers.

2000 onwards: EESoP/EEC¹⁰ and Government fuel poverty programmes installing condensing boilers; Energy Saving Trust working with manufacturing industry.

2002: Condensing boilers account for ~12% of UK market.

To achieve much higher levels is likely to require measures such as:

- a communications campaign raising awareness of links between climate change and household energy use;
- training of heating engineers and gas fitters;
- voluntary agreement with industry on condensing boilers; and
- higher boiler standards required by building regulations for existing and new dwellings.

8 Ibid

9 www.saveenergy.co.uk

10 EESoP - the Energy Efficiency Standards of Performance;
EEC - the Energy Efficiency Commitment.

- 3.14 A new EU directive on the energy performance of buildings is now in place¹¹. This covers homes alongside business and the public sector. It requires EU member states to set minimum standards for building work on new and existing buildings, to review building standards at least every five years, to introduce energy certificates for all buildings to show how efficient they are, and to test the efficiency of boilers and air conditioning systems in commercial and business premises.
- 3.15 We already have minimum standards for building work and a building certification system for dwellings and welcome the impetus the directive will give to these. We also welcome the challenge the directive presents to extend certification to all buildings and to introduce boiler and air conditioning inspection systems, or similar, that mean these can be operating more efficiently. The Office of the Deputy Prime Minister will take the lead in responding to the directive, as it has responsibility for most of the legislation that can be used to transpose it into law; however, DTI and Defra will also play a full part.
- 3.16 **We will start work immediately on the next major revision of the building regulations, which we will aim to bring into effect in 2005.** Tighter building regulations will also encourage developers to use low carbon solutions such as solar water heating and photovoltaics.
- 3.17 We will also make a start on developing the new provisions that will be needed to implement the directive's certification and inspection requirements, so that public buildings and those buildings that are sold or tenanted each year can be certified within the timescale required.
- 3.18 There is also a huge opportunity to deliver improvements through our public investment in schools, hospitals and other public services. In February 2003, we launched *Sustainable Communities: Building for the Future*¹², a long-term programme to increase housing supply in high demand areas such as the Thames Gateway. This includes a commitment that, from April this year, the Housing Corporation will require that the new homes they fund achieve the Building Research Establishment's EcoHomes¹³ standard for sustainable residential development.
- 3.19 Achieving these bigger and faster changes will require the concerted effort of all parts of the industry - customers (particularly in industry, business and the public sector), architects and designers, the construction industry, manufacturers and other suppliers, the professional bodies, energy companies and government itself. The shift to far greater energy efficiency is also an ideal opportunity to intensify the efforts already being made to improve the productivity of the construction industry. Our sustainable communities action plan is a major opportunity to encourage sustainable construction and maximise the potential that energy efficient technologies can play in the planned new housing developments and refurbishment of existing developments. **We will therefore bring together representatives of housebuilders, the Housing Corporation, the construction industry and others in a new working group** to consider how best to improve the

¹¹ The EC directive on the energy performance of buildings came into force on 4 January 2003. Member states have three years to implement the directive with an additional three years if needed to implement requirements on building certification and inspection of boilers and air conditioning systems. See www.europa.eu.int/eur-lex/en/dat/2003/l_001/l_00120030104en00650071.pdf

¹² www.communities.gov.uk

¹³ www.products.bre.co.uk/breeam/ecohomes.html

sustainability of all aspects of construction and design, including off-site construction and low carbon technologies (such as photovoltaics or CHP). **We will also bring together representatives of all the key players in a Better Buildings Summit**, which will be jointly convened and chaired by Ministers from ODPM, Defra and DTI.

- 3.20 We will also work with local authorities and their building inspectors to see whether and how enforcement of the regulations can be cost-effectively improved to achieve better correlation between design and built performance.

And higher product standards...

- 3.21 Today's homes contain more household appliances than our grandparents ever dreamt of - cookers, microwaves, washing machines, fridges and freezers, TVs and videos (with multiple sets in many homes), computers and game machines. UK households spend around £5 billion each year on electricity to power lights and appliances, which account for around a quarter of UK electricity consumption. And as these basic products achieve near universal take-up, new, energy-hungry services such as digital TV and broadband communications pose a new challenge.
- 3.22 Not only are these new gadgets energy-hungry, but as users most of us are also energy-lazy. Each year, video recorders and televisions in the UK consume around £150m worth of electricity while on standby, and our homes have increasing numbers of power supplies and chargers permanently plugged in. Consumer education can only have a limited effect in this area. Instead, we need to raise

the standards of the products themselves to give us the best technological answers for cutting energy consumption. Overall, faster improvements in the standards of new household appliances and greater uptake of A- rated appliances can bring about significant carbon savings and could save around 0.4MtC by 2010, relative to the business as usual baseline.

- 3.23 Similar issues arise in industry and commerce, where the speed of information and communications technology leads to new demands. At the same time, smart control systems can significantly cut usage and waste. Again, we need the best possible standards to ensure that equipment is as energy efficient as possible.
- 3.24 Overall, we need to remove the least efficient products from the market, encourage competition to bring forward improved products, and make it easier for people and businesses to choose the best. Ways to do so include minimum standards, voluntary agreements with industry, fiscal measures, procurement policy, and better information on product performance.
- 3.25 Provided manufacturers are given adequate time to change their product specifications, higher standards should not damage our industrial competitiveness. Indeed, properly designed, they can help British and other European manufacturers to anticipate and meet rising consumer expectations in other parts of the world. We will continue to consult closely with UK industry, including manufacturers, dealers and service providers, and with the European Commission and other member states, on how best to deliver low-cost improvements in product standards.

Our Market Transformation Programme¹⁴ already works at national and EU level with Governments, industry, retailers and others.

3.26 We are already encouraged by industry's response to this agenda, especially in its self-commitments to improve efficiency standards and targets for such things as electric motors, televisions, video recorders, digital TV services, power supplies, water heaters and washing machines. The European code of conduct on digital TV services has enabled the UK to avoid additional energy consumption equivalent to around 0.4MtC a year. We will encourage and support such industry self-commitments when these will deliver earlier or higher standards than mandatory measures alone.

3.27 The UK's membership of the single European market means that product standards on tradable goods and equivalent industry voluntary agreements usually have to be set or agreed at the EU level. Mandatory standards to remove inefficient boilers, fridges and fluorescent lamp ballasts¹⁵ from the market are already in force and are very effective. For example, even the least efficient new fridge freezer in the EU now consumes only half as much energy compared to products that were still on the market 5 years ago. The standard for lamp ballasts alone will save nearly 0.25MtC a year in the UK.

3.28 The Commission is now proposing a new framework directive¹⁶, to set standards for a wider range of products, and to revise the energy labelling regime which currently deals only with household appliances.

It has estimated that such measures could save around 10% of total EU energy consumption by 2020¹⁷. **We support these proposals and will work proactively to influence and speed their delivery.**

3.29 In particular, our analysis and consultations suggest that we should press for urgent action in the EU to raise standards in air conditioning, boilers and water heaters, power chargers, consumer electronics, office equipment, motors, fans and pumps, washing machines, fridges and other white goods and lighting, including significant reductions in standby power.

3.30 We will also reinforce other measures to promote the sale of products above current EU minimum standards, including fiscal instruments, information tools such as the EU energy label, the Energy Saving Trust's Energy Efficiency Recommended logo and the Energy Star label for IT equipment.

In the home...

3.31 Tougher building regulations will have an impact on new homes, alterations to the existing stock and all replacement windows and boilers. But they will not deal with long-standing problems like the 15 million homes with inadequate wall insulation - either solid walls or unfilled cavities.

3.32 We have already introduced - in April last year - an energy efficiency commitment (EEC) for domestic energy suppliers, which runs until 2005. Each supplier¹⁸ has an energy saving target, which they can meet by encouraging

14 www.mtprog.com

15 A 'lamp ballast' controls the current passing through fluorescent lighting tubes

16 Proposal for a framework directive on the eco-design of end use equipment

17 European Commission background and discussion paper on a draft proposal for a framework directive on energy efficiency requirements for end-use equipment, April 2002. (This proposal is now integrated with the proposal in footnote 16).

18 Applies to licensed energy suppliers with at least 15,000 electricity and/or gas customers.

householders to install energy saving measures, for example by subsidising the cost of installing a condensing boiler, wall or loft insulation, energy efficient lights and appliances either directly or through retailers. At least half the target must be met in households whose occupants are either on a low income or disabled. It is already accelerating the uptake of energy efficiency measures, reducing the cost of measures to the consumer, and encouraging the heating and insulation industries to build up their capacity to meet the increased demand. But by 2005, when the current EEC ends, there will still be around 6-7 million homes where cavity wall insulation would be relatively easy to install. Filling 4.5 million of these by 2010 would save around a further 1.2 MtC.

3.33 Energy suppliers have responded positively, and are working hard to meet their targets. We want their good work to continue, and for it to become an integral part of their long-term business strategies. So, **we will consult on an expansion of the EEC to run from 2005 to at least 2008, at possibly twice its current level of activity.** This will allow energy suppliers and the energy efficiency industries to plan the level of EEC activity over the medium and longer term. It will require energy suppliers to take up a substantial proportion of the potential for higher energy efficiency in homes, and deliver carbon savings of around 1 MtC by 2010, primarily by encouraging better home insulation. As we introduce the new EU emissions trading scheme, we will consider how the EEC can be best dovetailed with it. Looking to the future, a continuation and further expansion of EEC, or some successor mechanism, could deliver a further 3 MtC of savings by 2020.

3.34 While energy suppliers are selling energy saving measures under EEC, few have sought to develop new markets in energy services. Rather than simply selling electricity and gas, energy services focus on the outcome the customer wants - such as warm rooms and hot water - and offer the most cost-efficient way of achieving it. Under an energy services contract a supplier might, for example, install insulation or a more efficient boiler in a customer's home, and recoup the investment through the quarterly bill over, say, 3 to 5 years. The householder uses less energy as a result, and the savings on the energy bill are used to repay the cost of the measures. So, worthwhile home improvements are installed with no upfront cost to the householder, who benefits from a warmer, more comfortable home and lower energy bills for years to come once the initial investment has been repaid. Some have called this approach selling 'negawatts' instead of 'megawatts'.

3.35 Energy services could help to overcome consumers' reluctance to invest in energy efficiency improvements. However, since the energy markets were opened up to competition in the late 1990s, householders can switch supplier by simply giving 28 days' notice. Energy suppliers have little incentive to offer energy service contracts if customers can switch at short notice. **We will therefore establish a working party with OFGEM, energy suppliers and others to explore how to create an effective market in energy services.** This will address, among other issues, the barriers caused by the current 28-day notice period while maintaining adequate freedom of choice and consumer protection for customers. It will report initial conclusions later this year.

3.36 We will also continue to tackle poorly insulated and inefficiently heated homes through our **fuel poverty and social housing programmes** (see chapter 8). Because these focus on helping people heat their homes adequately, in the short term their contribution to carbon savings is relatively small. But they will help to ensure that we have a much more energy efficient housing stock in coming decades.

At work...

3.37 In businesses and the public sector, there are many ways to reduce energy use. Improving insulation, heating, lighting and equipment are important, particularly in the commercial and public sectors. There are also many other opportunities in day-to-day operations and production processes. Many savings can occur at the time of investment in new or replacement plant. Technologies include more efficient motors, variable speed drives, heating and cooling plant and proper pipe insulation. Savings can also come through making productive use of otherwise 'waste' heat and cooling, and avoiding unnecessary heating and cooling through better design and control.

3.38 As chapter 2 explained, we have already put in place a range of actions to promote energy efficiency in business. The climate change levy (CCL) is a levy on business and public sector energy use. Receipts (around £1 billion a year) are recycled back to business, mainly through reduced National Insurance but also through £50 million for tackling business energy efficiency. Within the CCL, climate change agreements (CCAs) have been negotiated with energy intensive industries. Participants pay only 20% of the CCL in

return for agreeing to meet challenging energy efficiency targets over a 10-year period. The CCAs alone are expected to achieve savings of around 2.5MtC by 2010.

3.39 We launched the world's first economy-wide greenhouse gas emissions trading scheme in April 2002¹⁹. By December 2002, 34 companies had become members, while a further 6000 companies with CCAs can use the trading scheme either to help meet their target or to sell any over-achievement. The targets set for participants in the scheme should deliver 1.1MtC of carbon equivalent²⁰ savings by 2006.

3.40 Taken together, the savings generated by these schemes account for most of the 6MtC of savings identified under the Climate Change Programme. Beyond that, three other mechanisms help business improve efficiency:

- building regulations;
- the Carbon Trust (see box below); and
- the Enhanced Capital Allowances Scheme²¹ which enables businesses to claim 100% first year capital allowances on investments in energy saving technologies.

3.41 Chapter 2 noted that policies will in future need to be reviewed in the light of the emerging EU emissions trading scheme.²²

We will also consider whether to extend the EEC beyond the domestic sector, perhaps to businesses that do not pay the

19 www.defra.gov.uk/environment/climatechange/trading/

20 The UK emissions trading scheme includes all 6 greenhouse gases. All savings are expressed in terms of the estimated global warming potential on an equivalent basis to those from carbon dioxide.

21 www.eca.gov.uk/

22 In addition, the linkage with the integrated pollution prevention and control (IPPC) directive will need to be clarified.

CCL, as a means of improving their energy efficiency. We would consult fully on such a proposal if we concluded that it was the right approach.

In the public sector...

3.42 The public sector accounts directly for only 5% of UK carbon dioxide emissions. But this sector - in particular the Government itself - has a vital role to play in leading by example.

3.43 Government, along with other public sector organisations, is taking action to improve energy efficiency. For example:

- we will be showing leadership in our own performance. The central Government estate has an interim target to reduce carbon emissions by 1% a year from 1999-2000, **with new targets to be set in 2003, including on CHP** (see chapter 4). Our review of government procurement has identified a number of areas where government purchasing could more strongly support sustainable development goals. The review has been considering how to build energy efficiency into government procurement and contract strategies, and identified some specific categories where products are already available which meet high energy efficiency standards. As a result we have made central arrangements for departments to purchase goods with high energy efficiency standards and which provide value for money in areas such as IT equipment, boilers, lights and lighting systems, refrigeration equipment, televisions and washing machines. We will be implementing our conclusions later this year;

- NHS Trusts are already targeted to reduce the level of primary energy consumption by 15% or by 0.15 MtC equivalent from March 2000 to March 2010²³; and
- since 2002/3 local authorities have been required to benchmark their energy use in operational property and street lighting and will set local improvement targets from 2003/04. Along with Registered Social Landlords, they are also required to bring their own housing stock up to decent standards by 2010.

Preparing the market and helping people make choices...

- 3.44 **With the Devolved Administrations we will continue to support the work of the Energy Saving Trust and the Carbon Trust** which provide free advice to households, businesses and public sector bodies on how to save energy. Raising awareness and providing targeted advice and information is a cost-effective way of overcoming barriers to energy efficiency. Advice also supports EEC by encouraging customers to take up the energy suppliers' offers. The UK-wide network of Energy Efficiency Advice Centres might, over time, evolve to become Local Sustainable Energy Advice Centres, covering energy efficiency, renewables and transport energy use.

23 www.nhsestates.gov.uk/sustainable_development/index.asp

Encouraging energy efficiency in homes, business and the public sector

Government and the Devolved Administrations provide funding for the Energy Saving Trust and the Carbon Trust to stimulate the uptake of energy efficiency in homes, business and the public sector.

The **Energy Saving Trust**²⁴ (EST) works in partnership with manufacturers, retailers, installers, energy suppliers, local authorities, advice providers and others. EST seeks to ensure the most effective delivery of energy efficiency to homes and small businesses for consumers, the 'Energy Efficiency' branding and marketing programme aims to transform attitudes to energy efficiency.

The **Carbon Trust**²⁵, launched in April 2001, is developing and implementing programmes to accelerate the take-up of energy efficiency in the non-domestic sector. These include the 'Action Energy' information and advice service; an interest-free loan scheme for small businesses; and stimulating innovation in new low-carbon technologies.

- 3.45 Our forthcoming Housing Bill will propose a requirement for home sellers to produce a sellers pack. This will be necessary for us to comply with the requirements of the EU buildings directive. The pack will promote energy efficiency by ensuring all homebuyers have access to information on energy performance of the homes they are considering buying.
- 3.46 We also need to ensure that industry is suitably qualified to deliver the measures we have set out. Our policies to improve training and skills are outlined in chapter 7.

24 www.est.org.uk

25 www.thecarbontrust.co.uk/thecarbontrust/default.htm

Encouraging innovation...

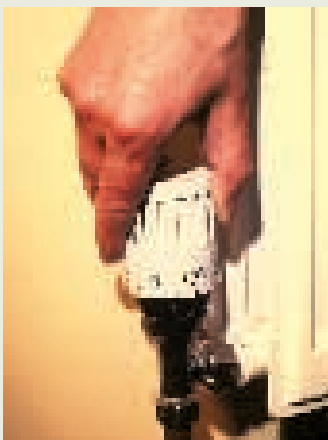
- 3.47 We need to develop even smarter ways to satisfy our energy needs, through better building techniques and products. Industry needs to continue to develop more efficient manufacturing processes that improve resource productivity. New types of meters will be needed to enable homes and businesses to make the best use of on-site electricity generation through renewables or CHP. And once products have been developed we need to get them deployed into the market. We agree with the recommendation of the Chief Scientific Adviser's Energy Research Review Group that energy efficiency should be treated as a priority area in which increased investment in research and development is particularly likely to yield major breakthroughs. The research and development to enable these technologies to make a contribution in the years to come needs to start now. The Carbon Trust's Low Carbon Innovation Programme²⁶, launched in 2002, provides funding to enable that to happen.
- 3.48 The new generation of buildings could have both minimum energy requirements and produce their own electricity through new and emerging technologies such as micro CHP²⁷, photovoltaics and fuel cells. Some homes that use little or no energy for heating already exist in the UK. In 2002-03 we introduced two new programmes - Community Energy and Clear Skies (a community and household renewables scheme) - worth £60m over three years to support CHP and renewable energy technologies.

26 www.thecarbontrust.co.uk/foundation/

27 Micro-CHP enables the simultaneous production of heating and electricity in the home and in small businesses. It is likely to operate in place of a domestic central heating boiler. CHP policies are further discussed in chapter 4.

Reporting progress...

- 3.49 These strands of policy in different sectors add up to an ambitious strategy for change. Further work is needed to consult on and put in place some of the detailed policies that will deliver it, for example as the scope and operation of the EU emissions trading scheme becomes clearer. But we do not want to lose momentum. **So, within a year, we will publish an implementation plan that sets out in further detail how we will deliver the strategy that we have set out here.** This will update and expand on the measures set out in the Climate Change Programme. **From then on we will report annually, as part of the follow up to this white paper, on progress towards achieving the savings we have set out.**



Chapter 4 Low carbon generation

4.1 A new energy policy demands new thinking about energy supply. We need a shift towards energy sources and generation technologies that produce much less or no carbon. We can expect to see far more small-scale, distributed heat and electricity generation.

4.2 In particular:

■ renewable energy will play a vital part.

To date, renewable energy has expanded far less in the UK than in some other European countries. Yet the potential is huge. For example, the UK has over one third¹ of Europe's entire potential for offshore wind energy. And there is great scope for innovative, local developments, bringing together low carbon technologies such as renewable energy and energy efficient buildings²; and;

■ combined heat and power (CHP), which is an efficient form of providing heating and electricity at the same time, also fits into this wider picture. The UK already has around 5GW of CHP installed, mainly on an industrial scale. In the future, we can also expect to see far more 'micro-CHP' - efficient, small-scale heating and electricity generation systems in homes as well as businesses.

4.3 Although nuclear power produces no carbon dioxide, its current economics make new nuclear build an unattractive option and there are important issues of nuclear waste to be resolved. Against this background, we conclude it is right to concentrate our efforts on energy efficiency and renewables. We do not, therefore, propose to support new nuclear build now. But we will keep the option open.

4.4 This chapter looks at the role that we can expect renewables and CHP to play; examines the obstacles to their greater take-up; reviews the short and longer-term technological opportunities and the role we can play in promoting them; and sets out our conclusions on the role of nuclear power.

The role of renewables...

What is renewable energy?

Renewable electricity can be generated from wind power, wave, tidal, solar photovoltaics (PV), hydro generation, geothermal and biomass (energy from forestry or crops). These forms of generation offer an enormous potential resource, particularly in the UK where our coastline provides extensive opportunities to use wind, wave and tidal power. They all produce no carbon at all or, in the case of biomass, produce only the carbon they have already absorbed from the atmosphere when growing. Some forms of waste are also classed as renewable under the Renewables Obligation.

Solar energy can heat water directly, either for hot water or for space heating in buildings. And heat from the ground, river water, sewage and even the air can be put through a heat exchanger for both water and space heating.

4.5 If we are to achieve a 60% reduction in carbon emissions by 2050, we are likely to need renewables by then to be contributing at least 30% to 40% of our electricity generation³ and possibly more. We therefore need to develop a framework which encourages the development of a wide range of renewable options and to make significant changes to our institutions and systems.

1 BWEA, 2002 www.offshorewindfarms.co.uk/info.html

2 Renewable fuels will also be important in transport. This is discussed in chapter 5.

3 *Options for a low carbon future* (Future Energy Solutions, 2003) www.dti.gov.uk/energy/whitepaper

We have made a start...

4.6 In January 2000 we announced our aim for renewables to supply 10% of UK electricity in 2010, subject to the costs being acceptable to the consumer⁴. It is clear that achieving the 10% target over the next seven years will be very challenging.

4.7 We have recently put in place a range of new measures to deliver this. We have:

- introduced a Renewables Obligation for England and Wales in April 2002⁵. This will incentivise generators to supply progressively higher levels of renewable energy over time. The cost is met through higher prices to consumers. By 2010, it is estimated that this support and Climate Change Levy (CCL) exemption will be worth around £1 billion a year to the UK renewables industry;
- exempted renewable electricity from the CCL;
- created a renewables support programme worth £250m from 2002-2005;
- drawn up a strategic framework for a major expansion of offshore wind; and
- created a new organisation within Government - Renewables UK - to help our renewables industry grow and compete internationally.

In addition, from 2005 onwards, the EU emissions trading system will provide a further incentive for renewables.

4 *Conclusions in response to the public consultation - New and Renewable Energy: Prospects for the 21st century* (DTI, 2000)
www.dti.gov.uk/renew/condoc/policy.pdf

5 The Scottish Executive launched the Renewables Obligation Scotland on 1 April 2002. We make proposals in paragraph 4.64 on integrating the Renewables Obligation Certificate trading schemes for Great Britain and Northern Ireland.

4.8 We are pushing forward these programmes in consultation with industry. A new Renewables Advisory Board - comprising representatives of the relevant industries, the Government and the Devolved Administrations - has been set up with a remit to provide expert independent advice to DTI on renewables issues.

But we need to do still more...

4.9 We produce less electricity from renewables than a number of our European partners. In 2000, renewables (excluding large hydro plant and mixed waste incineration) supplied only 1.3%⁶ of our electricity, compared with 16.7% in Denmark, 4% in the Netherlands, 3.2% in Germany and 3.4% in Spain. To hit the 10% target we will need to install approximately 10,000MW of renewables capacity by 2010, an annual build rate of over 1250MW. Only 1200MW of renewables capacity has been installed in total so far (excluding large hydro). The measures we have already put in place will make a major difference to the rate at which capacity is installed. But they were only introduced last year and it will take a few years before these measures impact fully.

4.10 Our analysis and consultation has shown that we need to strengthen our policy if we are to ensure that the measures we have put in place have the maximum impact. We describe below a number of steps that we will take to accelerate the take-up of renewables.

4.11 As we have set out, our aim for renewables is that they should supply 10% of UK electricity in 2010, as long as the cost to customers is acceptable. We believe that renewable sources of energy will increasingly

6 *Renewables Information 2002* (IEA, 2002)
www.iea.org/stats/files/ren2002.pdf

demonstrate that they can meet our energy needs both economically and in a carbon free way. Technologies such as onshore and offshore wind and biomass are potentially - after energy efficiency and alongside CHP - the most cost-effective ways of limiting carbon emissions in the longer-term. We expect industry to respond to the framework established by the Government and demonstrate they can achieve our goals at an acceptable cost. **On that basis, our aspiration is by 2020 to double renewables' share of electricity from our 2010 target and we will pursue policies to achieve this.**

4.12 We remain firmly committed to the current Renewables Obligation and will maintain the level of support it provides as planned until 2027. **In 2005/06, we will review progress and will elaborate a strategy for the decade to 2020.** This will take account of the experience of carbon prices arising from the emissions trading scheme and of the costs of renewable technologies.

4.13 We have already put in place a substantial renewables support programme worth in total £250m between 2002/03 to 2005/06. But we recognise that further funding is needed to give us the best chance of reaching the 2010 target. **We will therefore increase funding for renewables capital grants by a further £60m within this period. This is additional to the extra funding announced in the 2002 Spending Review, which allocated an additional £38m for energy policy objectives in 2005/06⁷.** This funding will enable us to increase momentum and to take forward a broad strategy for renewables including ramping-up medium-term funding for offshore wind.

4.14 As well as making progress towards our 2010 target, and paving the way for our 2020 strategy, we need to make sure that we are planning for the longer-term up to 2050. We are already reviewing innovation spending, including that for renewable energy, across government. With respect to renewable energy, we will review the barriers to successful innovation across the range of renewables technologies and will set out a programme for developing, with industry, strategies for the successful application of those technologies in the liberalised energy market. We expect this work to cover advanced conversion technologies for biomass, wave and tidal, building-integrated renewables, and hydrogen and fuel cells.

Innovation, research and development are crucial...

4.15 Key to realising the full potential of renewables over time is the generation of innovative ideas which will bring on new technologies as well as improving existing ones. The Chief Scientific Adviser's Energy Research Review Group⁸ recommended that more needed to be spent on energy research and development and singled out two renewables technologies (solar PV and wave/tidal power) as areas in which increased investment was particularly likely to lead to step-change breakthroughs. **We accept these recommendations and have already increased funding for basic research into renewables (see paragraphs 4.60 and 4.61).**

⁷ Compared with 2002/03

⁸ *Report of the Chief Scientific Adviser's Energy Research Review Group*, Office of Science and Technology, 2001. www.ost.gov.uk/policy/issues/csa_errg/main_rep.pdf

Combined heat and power also has significant potential...

- 4.16 CHP is an efficient form of providing heating and electricity at the same time. CHP's overall fuel efficiency is around 70-90% of the input fuel - much better than most power stations which are only up to around 40-50% efficient. It enables a very wide range of energy users, from heavy industry down to individual homes, to save money and help the environment by reducing overall carbon emissions. It is also the cornerstone of many community energy schemes, providing heating, electricity and in some cases cooling to a wide range of users. But the low prices in the wholesale electricity market and the increases in wholesale gas prices over recent years are adversely affecting new CHP developments. A number of proposed new power stations, which already have planning approval, are awaiting electricity price rises and/or gas price reductions before they go ahead.
- 4.17 We have set a target of achieving 10GWe of Good Quality CHP⁹ by 2010. Good progress has been made over the last decade and 4.8GWe is currently installed. Achieving the Government's target could save a further 1.25MtC per year. **We remain committed to a target of 10GWe of Good Quality CHP capacity being installed by 2010.**
- 4.18 **In addition to the measures we have already put in place to support CHP, we will introduce a number of further measures to help address the current market difficulties and support the achievement of our target:**

- **we will undertake a review of the existing guidance on information required to accompany power station consent applications.** Applicants will need to provide significant evidence clearly demonstrating they have considered all economically viable options for CHP and community heating;
- **we will continue to emphasise the benefits of CHP and community heating whenever Planning Policy Guidance, Regional Planning Guidance or Sustainable Development Guidance is introduced or reviewed;**
- it is vital that NETA does not discriminate against smaller generators, including CHP. Some changes have already been made. We expect OFGEM to continue to work with smaller generators and ELEXON to ensure that the administrative procedures for the Balancing and Settlement Code under NETA are fully accessible to smaller generators. **We will work with OFGEM to keep these developments under review since the existence of a level playing-field for smaller generators, including CHP and renewables, is essential if our ambitious targets are to be met;**
- in the draft CHP Strategy we announced that we would consider setting targets for Government Departments to use CHP generated electricity. **We will now proceed with this. Over the coming months we will consider the nature and extent of such a target or targets and announce our conclusions in the energy section of the Framework for Sustainable Development on the Government Estate that we hope to publish later this year. We will also encourage other parts of the public sector to consider whether setting CHP targets would be appropriate;**

⁹ Good Quality CHP is CHP generation that meets efficiency standards prescribed in the Government's CHP Quality Assurance programme.

- **as we consider and consult on the expansion of the energy efficiency commitment (EEC) for households from 2005 onwards and on whether to extend the EEC beyond the household sector (see chapter 3), we will explore the opportunities for incentivising CHP technologies;**
- **we will support field trials designed to evaluate the benefits of micro-CHP;**
- we recognise that the CHP target will require sustained effort from both the private and public sectors, and can therefore only be achieved with the active collaboration of all the partner organisations which have a contribution to make. **We have invited the Energy Saving Trust and the Carbon Trust to review their current and future programmes to ensure that they reinforce the delivery of the Government's CHP target; and**
- over time the measures outlined in this white paper - in particular emissions trading - will encourage lower-carbon forms of generation and more efficient use of fuels. **Under the UK Emissions Trading Scheme, carbon savings from CHP can already be traded, and we will work on a framework for pilot projects within the Scheme for which CHP projects may be eligible.** This work would take into account the forthcoming EU Directive on emission reduction projects. Furthermore, the EU emissions trading scheme will encourage low-carbon technologies, including CHP. And we expect to see a new approach to electricity generation developing that recognises and encourages local generation opportunities.

- 4.19 These measures will be elaborated in the final version of our CHP Strategy to be published in the course of this year, on which we look forward to a continuing and constructive dialogue with industry.
- 4.20 **We will also monitor and report on developments on CHP as part of the arrangements described in chapter 9.**

Structural barriers to renewables and CHP...

- 4.21 Many renewable and CHP generators, because of their small size and/or location, need to be connected to local distribution networks rather than the national transmission network. To achieve our targets for higher levels of renewable generation and CHP plant, distribution networks will have to be capable of accommodating many more directly connected generators. Very substantial changes will be needed in the way in which our distribution networks are designed, organised and financed - greater than anything we have seen in the last 50 years. Distribution Network Operators (DNOs) will also need to take a more proactive approach to distributed generation.
- 4.22 During the white paper consultation, distributed generators expressed concern that their projects were being unduly delayed because they could not obtain quick and easy connections to the distribution network. Under the present price control rules there is no financial incentive for the DNOs to connect distributed generation to their networks. We therefore believe that the regulatory framework needs to be amended so that the DNOs connect and use higher levels of distributed generation.

- 4.23 OFGEM has started working with the DNOs to address these issues¹⁰. **OFGEM is committed to publishing the detail of an incentive framework for connecting and utilising distributed generation later this year, for implementation in April 2005.** This will help distributed generators to obtain quicker and easier connections to the distribution network in the interim period to the next price control and beyond. DNOs need to work closely with the industry to exploit the existing infrastructure by using innovative engineering solutions when connecting higher levels of distributed generation.
- 4.24 **We are also working with OFGEM to address the administrative burdens placed on smaller generators and to ensure that they are not unfairly disadvantaged in their relations with local suppliers¹¹. Through the Distributed Generation Co-ordinating Group¹², we are also following up a range of wider changes designed to facilitate distributed generation. We will report progress on this in the follow-up to the white paper (see chapter 9).**
- 4.25 We need to develop the existing transmission network to exploit our massive onshore and offshore wind resources. Transmission companies must start preparing now to

strengthen the network to enable the UK to increase substantially its deployment of renewables. **The regulatory arrangements are crucial to our ability to deliver infrastructure which will, in turn, permit the development of renewable generation throughout the country - not least in those peripheral areas where natural resources are often greatest. Discussions are currently taking place between OFGEM and the transmission operators on plans to upgrade the transmission network across the whole country. We are also consulting on network issues across Great Britain (GB) in the context of the forthcoming British Electricity Trading and Transmission Arrangements (BETTA) legislation (as discussed in paragraphs 4.28 and 4.29). It is essential to create a network infrastructure capable of supporting our environmental objectives.**

- 4.26 **We are establishing with OFGEM a joint working group on environmental issues¹³ modelled on the successful joint working group on security.** One of the key priorities for the group will be to monitor network operators' progress in modernising the transmission and distribution networks to meet our carbon aims.

The New Electricity Trading Arrangements (NETA) are evolving to respond to industry concerns...

- 4.27 During the first few months of NETA some generators, in particular renewables and CHP, were exposed to very high costs as a result of the mechanism used to balance the

10 In January 2003 OFGEM published its initial thoughts on both the principles for developing the regulatory framework for the next distribution price control and on interim arrangements for the period to April 2005 when the next price control is implemented. www.ofgem.gov.uk/docs2003/dnoletter_jan.pdf

11 OFGEM has recently launched a help facility for smaller generators under NETA www.ofgem.gov.uk

12 The DTI and OFGEM created and jointly chair the Distributed Generation Co-ordinating Group. The Group is concerned with a wide range of issues related to the connection and operation of distributed electricity generation in Great Britain. The Group is also considering recommendations made by an earlier group (Embedded Generation Working Group) on how to encourage DNOs to connect higher levels of distributed generation www.distributed-generation.org.uk

13 As discussed in chapter 9.

electricity system. NETA is evolving to deal with these problems. It is important that the balancing mechanism reflects costs and that the system as a whole provides a realistic route to market for all generators. We have worked with OFGEM to make the balancing mechanism more genuinely reflect costs. A number of amendments have been made since NETA was introduced¹⁴. This has helped all players but especially smaller generators such as renewables and CHP to operate more effectively in the market. OFGEM has also approved a proposal to introduce in February 2003 a further amendment that should more accurately reflect the costs of being out of balance¹⁵. OFGEM is also committed to continuing to work with smaller generators to ensure that the Balancing and Settlement Code is fully accessible to smaller generators¹⁶.

We will continue to keep the operation of these aspects of NETA under close review.

We discuss the impact of NETA on the electricity industry as a whole in chapter 7.



What is NETA?

The New Electricity Trading Arrangements (NETA) were introduced in England and Wales on 27 March 2001. NETA replaced the Electricity Pool whose centralised, inflexible arrangements for setting wholesale electricity prices meant that prices failed to reflect falling costs and increased competition.

NETA put in place market-based trading arrangements, more like those in other commodity markets. The majority of electricity is traded through bilateral contracts where prices are agreed between parties and on power exchanges, the remainder, around 2%, is traded through the NETA balancing mechanism.

The Balancing Mechanism has two functions. As electricity cannot be stored, the transmission system has to be balanced on a second by second basis to ensure system security. The National Grid Company (NGC) operates a balancing mechanism to do this. The 2% of electricity traded through the balancing mechanism is due to generators and suppliers being out of balance with their contracted position; either a generator not producing enough or too much electricity or suppliers not consuming enough or too much electricity. NGC then has to accept offers for more electricity, or bids to produce less. These additional costs to NGC are passed on through imbalance charges.

14 Modification P12 to the Balancing and Settlement Code (BSC) was implemented on 2 July 2002. This has the effect of reducing gate closure to one hour and has helped all participants (and especially less predictable generators) better manage the risk of being out of balance.

15 Modification P78 to the Balancing and Settlement Code (BSC).

16 The Balancing and Settlement Code covers the trading, balancing and subsequent settlement of electricity.

BETTA...

- 4.28 We have announced that we intend to bring forward legislation to create a wholesale electricity market for GB as soon as Parliamentary time allows. The development of these new arrangements, is being undertaken with OFGEM and with the involvement of industry. For planning purposes, we are working towards the implementation of BETTA in October 2004. We intend to implement BETTA by April 2005 at the very latest.
- 4.29 BETTA will mean that Scottish domestic and business customers will benefit from the same levels of competition that are now established in England and Wales. The single set of trading rules, connection policies and transmission charging arrangements under BETTA will reduce barriers for independent generators across GB to getting their power to market. BETTA will help to create a diverse generating base in GB and encourage new transmission capacity, helping to support renewables development.

Planning needs to be streamlined and simplified ...

- 4.30 Many of those who responded to the white paper consultation saw planning as one of the big obstacles to new renewables. We recognise that this is a serious problem for renewables. **The Office of the Deputy Prime Minister (ODPM) will shortly publish new planning guidance on renewables (PPS22)**

for England¹⁷. A separate guide containing advice on best practice will also be published. These documents will provide guidance to local planning authorities and developers about the best way to promote renewables through the planning system as well as encouraging a strategic approach to the deployment of renewable projects through regional planning guidance and development plans. We will also be consulting on a new regional-level strategic approach to energy issues, including renewables, which we expect will incorporate regional targets, as discussed further in chapter 9. This approach will help to encourage regional bodies as well as local authorities to examine strategically the resources and opportunities for renewable projects within their areas and what they can do to develop them in their region.

- 4.31 **ODPM, in partnership with other government departments, will be examining how to bring consideration of the use of renewables and energy efficiency in developments more within the scope of the planning system, in the context of the review of PPG22 and the Government's wider planning reforms, and in a way that does not impose undue burdens on developers.**

- 4.32 We need better information on what is happening on the ground. **We will therefore work with local planning authorities and others to obtain better statistics on the number of renewable projects that are achieving planning approval and why others are being rejected.**

¹⁷ The Welsh Assembly Government is currently revising its national planning guidance on renewables (TAN8) and has commenced the process of developing a Wales spatial plan. The Scottish Executive updated its national planning guidance (NPPG6) in 2000.

4.33 We have published legislative proposals¹⁸ to streamline the public inquiry process for Major Infrastructure Projects in the planning process in England by allowing lead inspectors to appoint further inspectors to share the work and allowing issues to be considered concurrently in inquiries rather than sequentially. **We will also apply these principles to decision-making for major energy projects in England and Wales, where consents are awarded by the Secretary of State for Trade and Industry.**¹⁹ This should help streamline planning processes for large renewable energy developments and other large generation plant and help major upgrades of the transmission network.

4.34 There is currently no guidance on the implications for land use planning at local level for projects related to energy reliability. **We will prepare a separate guidance note focusing on this for local planning authorities.**

People make the difference ...

4.35 Increasing the deployment of renewables will depend on people supporting local projects²⁰. The public consultation suggests people are keen on renewables, particularly for their contribution to tackling climate change. But they feel that they do not know enough about the impact of renewables in practice.

4.36 The white paper consultation has shown the value of community engagement. This will be crucial for the development of new forms of

distributed generation, in gaining acceptance of new infrastructure and in developing opportunities for local energy delivery. Developers need to continue to engage local planning authorities and work directly with communities. We have recently launched Clear Skies, a three-year capital grant programme worth £10m, for schemes such as solar water heating and biomass heat which have a strong community or household focus. The Scottish Executive has also a similar community and household capital grants scheme in Scotland worth £3.7m over 3 years. Defra's Community Energy scheme, which has a two-year budget of £50m, helps install and refurbish community heating systems. The Countryside Agency launched the Community Renewables Initiative in 2002 to help people to influence and benefit from renewable energy. All of these schemes have a key role to play in helping to breakdown the barriers to public acceptability of renewables by providing local residents with a direct benefit from the renewables development.

Community action in practice

National Wind Power's practice is to establish community funds at each operating wind farm in consultation with local communities and councillors. These funds benefit the community and typically include student sponsorships, equipment for schools and village halls repairs.

One such example is the provision of IT and other equipment worth up to £60,000 to support 19 schools near the Bears Down Wind Farm in Cornwall. Local schools also received two days energy efficiency training as part of a £30,000 energy efficiency scheme funded by the wind farm and carried out by the Cornwall Energy Advice Centre.

18 *Planning and Compulsory Purchase Bill*
www.publications.parliament.uk/pa/cm200203/cmbills/012/2003012.htm

19 These powers are devolved in Scotland.

20 *Renewable Energy in the UK* (PIU, 2001)
www.piu.gov.uk/2001/energy/Renewener.shtml

4.37 We see a clear benefit in local communities becoming producers, as well as consumers, of energy, establishing and benefiting from the local ownership of some forms of generation. To help promote ideas and good practice **we will collate and publish examples of projects in which developers have gained added value by taking innovative approaches to engaging and working with communities, in partnership with local government and the renewables industry.**

We will simplify the procedures for accommodating our national security needs...

4.38 The Ministry of Defence (MoD) needs to make sure that windfarm developments do not impair operational needs including training and radar monitoring. MoD has objected to a third of all recent on and offshore wind energy proposals²¹. We need to work with the industry to reduce this.

4.39 To address these issues, MoD:

- has contributed to the issue recently of new guidelines for windfarm developers through the Wind Energy, Defence and Civil Aviation Working Group²², designed to increase the transparency of the process for assessing wind proposals;
- will provide more central guidance to those reviewing applications, develop a help line for the industry and shorten proposal turn-around times from the current 6-8 weeks;

- will provide advice to developers on any adjustments that could be made to the location of a wind farm in order to make it acceptable to MoD. If this is not possible, MoD will explain to developers the problem of siting a wind farm in the locality; and
- is supporting research to model the effect of turbines on radar and to identify ways in which adverse impacts could be reduced, including technical adaptations to turbine design.

4.40 MoD is also ready to engage with local authorities and regional bodies as they move towards considering the best sites for wind farms in the longer-term when they begin to develop their regional strategies for energy, as discussed in chapter 9.

Learning to handle intermittency...

4.41 Renewables contribute to certain aspects of security of supply. Supplies will not be disrupted by international crises. But some will create additional system complications, depending on the extent to which they are intermittent (wind energy, wave energy, tidal and solar) and on the types of generation they displace. Intermittency causes additional system costs. And as the proportion of intermittent generation increases, the cost of maintaining stable supplies also increases²³.

21 Ministry of Defence (2002).

22 Comprising DTI, MoD, the Civil Aviation Authority, the British Wind Energy Association, the Devolved Administrations and others with an interest.

23 The additional system costs - attached to transmission, the distribution network and balancing generation and demand - of 20% and 30% of electricity supplied by intermittent generation is equivalent to a maximum of £0.9/MWh and £2.20/MWh respectively. It is quite possible that technical developments in storage, fuel cells and load management may by 2020 reduce such costs. *Quantifying the system costs of additional renewables in 2020 (Ilex, 2002)*. www.dti.gov.uk/energy/developpep/080scar_report_v2_0.pdf

4.42 These costs need to be managed and new ways found to minimise them. We are already funding research into this through the DTI's Renewable Energy and the Engineering and Physical Sciences Research Council's (EPSRC)²⁴ SUPERGEN²⁵ programmes. As part of our current capital grant programme we allocated in 2002 an additional £4m to facilitate the demonstration of new control, storage and metering technologies.

Renewable technologies are at different stages of development...

4.43 We need to scale up substantially our deployment of renewables in order to secure economies of scale and reduce costs significantly. Some renewable technologies are close to commercial deployment and should be pulled through to market by the range of measures that we have in place. With support from the Renewables Obligation and the Renewables Obligation Scotland, onshore wind is already economic. But we are also strongly committed to supporting the innovation that will be fundamental to bringing forward new and emerging technologies. The remainder of this chapter looks at what more needs to be done for us to fully establish a wide range of renewable options to deliver our carbon aims.

Offshore wind - about to take off...

- 4.44 We have more wind off our coasts than anywhere else in Europe²⁶. Given our experience in offshore engineering, we should be able to expect offshore windfarms to make a strong contribution to our carbon aims.
- 4.45 Developers have entered into agreements for leases for windfarm sites around the UK coast with a total capacity of at least 1400MW of renewable energy, sufficient to power a city the size of Greater Manchester. The offshore wind industry considers a further 3000-4000MW can be built by 2010.²⁷
- 4.46 Only 250MW²⁸ of offshore wind capacity has so far been installed world-wide. 4MW of this is in UK waters. Although the long-term potential looks promising, the economics of offshore wind are very uncertain. In the short-term significant fixed costs have to be borne before installation can begin. Our programme of capital grants has started to address this.
- 4.47 Delivering our carbon aims will require the rapid expansion of offshore wind not only within territorial waters but beyond. We published in November 2002 a consultation document²⁹, *Future Offshore*, which proposes a strategic planning framework to harness the significant potential of offshore wind. The *Future Offshore* consultation document includes proposals for the provision and regulation of offshore infrastructure for transmitting electricity.
- We will work with OFGEM, developers and the transmission companies, over the**

24 Government's leading funding agency for research and training in engineering and the physical sciences www.epsrc.ac.uk

25 Sustainable Power Generation and Supply initiative www.epsrc.ac.uk

26 BWEA, 2002 www.offshorewindfarms.co.uk/info.html

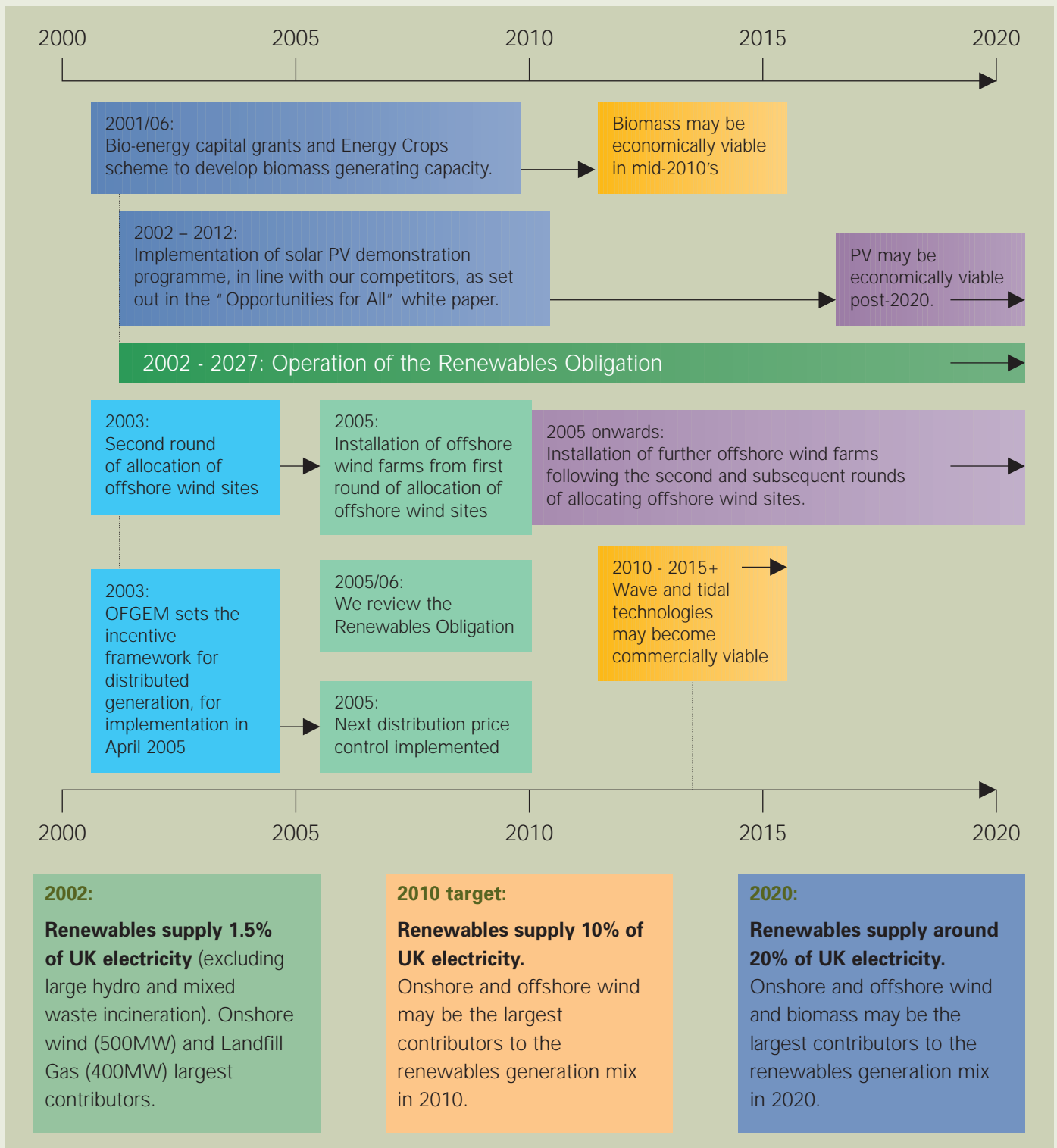
27 BWEA, 2002

28 BWEA, 2002

29 *Future Offshore: A consultation of the future framework for developing offshore wind farms* (DTI, 2002) www.dti.gov.uk/energy/leg_and_reg/consents/future_offshore/index.shtml

A Renewables Timeline

The timeline below shows the key dates on the critical path to help us to achieve our 2010 10% target and to double the renewable's share of electricity generation in the decade after.



coming months, to take this issue forward.

A second round of windfarm site allocations is planned for spring 2003, focusing on three strategic areas of the sea within territorial waters, informed by a strategic environmental assessment.

- 4.48 To enable further rounds to extend the opportunity for developers to exploit areas beyond the UK 12-mile zone **we will also bring forward legislation as soon as possible to enable the granting of licences for offshore windfarm developments beyond territorial waters. We will identify and assess the difficulties that might be posed for aviation and other military and civil interests before we offer areas of the sea to the wind industry for development.**

Biomass and waste technologies need to gain momentum...

- 4.49 Biomass³⁰ and waste can be used for electricity, heat and liquid fuels. Unlike wind, biomass and waste generation is flexible - it can be generated at any time. A strong biomass supply chain can also revitalise rural communities, offering diversification opportunities for farmers and foresters as well as job opportunities in growing, supply and electricity plant building. We are supporting biomass projects through our 3-year £66m Bioenergy Capital Grants Scheme and through our £29m Energy Crops Scheme, to help farmers and foresters establish energy crops.

- 4.50 To develop a stronger stimulus to provide a biomass supply chain, **we will undertake a statutory consultation in 2003 of the current requirement under the Renewables Obligation that by 1 April 2006 75% of the biomass in co-fired stations should be energy crops³¹.**

Elean Power Station - the UK's first straw-fired power plant

Elean Power Station at Sutton near Ely, Cambridgeshire, is the UK's first straw-fired power plant. With an electricity output of 36MW, it is the world's largest such facility. The power station will generate enough power to heat and light 80,000 homes.

The 200,000 tonnes/per year of straw needed to fuel the facility is being procured through long-term contracts with farmers and contractors located within a 50-mile radius. Running currently on 100% straw, Elean Power Station also has the capability of using a range of biofuels and up to 10% natural gas. Whatever the exact make-up of its fuel in the course of its life, the plant represents an important first in the development of renewables in the UK and a significant step forward towards the Government's objectives for renewables deployment over the coming years.

³⁰ Biomass is anything derived from plant or animal matter and includes agricultural, forestry or wood wastes/residues and energy crops. Energy crops are crops grown for the purpose of energy generation, such as short rotation coppice willow and miscanthus.

³¹ Stations that are powered by co-firing may have an important role to help deliver biomass and energy crops and in delivering renewable energy capacity quickly at relatively low cost. Under the current Renewables Obligation arrangements, electricity generated from biomass by co-firing in existing generating stations are eligible for Renewable Obligation Certificates (ROCs) subject to two restrictions. Only electricity generated before 1 April 2011 will be eligible and from 1 April 2006 at least 75% of the biomass must consist of energy crops.

- 4.51 The Government's Strategy Unit published a report in November 2002³² on its review into the delivery of our Waste Strategy 2000³³. The report includes the recommendation that we should ensure that there are financial incentives to develop new waste technologies, such as pyrolysis, gasification and anaerobic digestion. **We are now considering the recommendations of the report.**

Wave and tidal are further off but potentially very important ...

- 4.52 Wave and tidal technologies are rather further from commercialisation, with a number of competing designs. The UK is at the forefront of these technologies. On the island of Islay, we have the only commercially operational wave-power station in the world. Yet progress from research and development to more general commercial application has been slow. But, as recognised in the Chief Scientific Adviser's review, the UK has an opportunity here to develop world-leading expertise.
- 4.53 **Recognising this, we are supporting industry to develop prototype wave and tidal technologies in projects off the Western Isles and Devon coasts. We are also supporting, along with the Scottish Executive and others³⁴, the establishment of a marine test centre off the coast of the Orkney Islands. This centre, a first in Europe, is expected to open later this year.** We are determined that wave and tidal technologies should be given the opportunity to play the fullest part they can in the

expansion of generation from renewables. This in turn can create another significant opportunity, with world-wide application, for our manufacturing sector.

Energy from the Oceans - The Stingray Project

Funded under the DTI's Renewable Energy Programme, a Northumberland-based company The Engineering Business has successfully developed its ideas for a tidal stream generator system '*Stingray*' from concept through to demonstration stage. In September 2002, following early design work carried out under Phase 1 of its project, a 150kW full-scale prototype weighing 180 tonnes was built, installed and successfully operated on the seabed in Yell Sound, Shetland.

With early results encouraging, the technology will continue to be developed with further offshore testing planned this year. The company has plans to commence installation of a 5MW '*Stingray*' power station with connection to the local distribution network in summer 2004.

- 4.54 Large-scale tidal barrages have the potential to make a significant contribution to carbon reductions in 2020 or beyond. But such schemes have a very substantial impact on the local and regional environment and are very expensive, though some of the costs could be offset by other benefits. It is clear that plans for a Severn Barrage would raise strong environmental concerns and we doubt if it would be fruitful to pursue it at this stage. Tidal barrages may be capable of offering major renewable projects which will help us reach our goals and we will continue to explore opportunities.

32 *Waste Not, Want Not* (Strategy Unit, November 2002) www.piu.gov.uk/2002/waste/report/index.html

33 *Waste Strategy 2000 for England and Wales* (Defra, 2000). www.defra.gov.uk/environment/waste/strategy/cm4693/pdf/wastvol1.pdf

34 The Carbon Trust, Scottish Enterprise, Highlands and Islands Enterprise, Orkney Islands Council.

Solar PV is a potentially very large market...

- 4.55 The costs of solar PV technology have fallen substantially over the last 25 years and are widely expected to fall further as global markets expand. We committed in the *Opportunities for All* white paper³⁵ to embarking on a major initiative with industry and others to achieve a UK solar PV demonstration programme in line with those of our main competitors. The current programme, worth £20m over 3 years, is the first stage of this process.
- 4.56 At present solar PV qualifies for the Renewables Obligation. In practice almost all schemes are too small to generate the minimum 0.5MWh a month to qualify for a ROC³⁶. **We will explore whether there is scope through the European renewables Directive to help bring smaller sources of generation within the Renewables Obligation. Through the Distributed Generation Co-ordinating Group, we are also exploring the scope for developing simpler metering arrangements to help micro generators (including solar PV) obtain a fair value for the surplus electricity they export to the grid.**
- 4.57 The Chief Scientific Adviser's Energy Research Review Group also identified solar PV as a key research area and specifically recommended that work on novel emerging systems, such as organics and polymers, could offer major decreases in the costs of production.

³⁵ *Opportunities for all in a World of Change* (DTI, 2001) www.dti.gov.uk/opportunityforall/pages/contents.html

³⁶ Eligible renewable generators receive ROCs for each MWh of electricity generated. These certificates can then be sold to suppliers. In order to fulfil their obligation, suppliers can either present enough certificates to cover the required percentage of their output, or they can pay a "buyout" price of £30/MWh for any shortfall. All proceeds from buyout payments are recycled to suppliers in proportion to the number of ROCs they present.

Fuel cells offer a longer-term advantage...

- 4.58 Fuel cells produce electricity from hydrogen and air, with water as the only emission. Potential applications include stationary power generation, transport (replacing the internal combustion engine - as described more fully in chapter 5) and portable power (replacing batteries in mobile phones, laptop computers etc). Fuel cells also have the potential to help renewables produce more stable supplies. Hydrogen can be generated when electricity demand is less than that being generated by the renewable energy source. This can then be converted to electricity via the fuel cell when electricity demand exceeds that being generated by the renewable energy source.
- 4.59 To ensure that the UK is at the cutting-edge of fuel cells technology, **we will:**
- **following the Fuel Cells Market Study³⁷ funded jointly by DTI and the Carbon Trust, work with industry to produce a Fuel Cells Vision for the UK;**
 - **launch a new industry network, Fuel Cells UK, in May through which the industry can collaborate and work with us in implementing the vision (see Fuel Cells UK box);**
 - **develop a web-based fuel cells exchange so that global information can be accessed quickly and easily by UK industry;**

³⁷ *Review of Fuel Cells Commercial Potential for DTI and the Carbon Trust* (E4Tech, 2003) www.dti.gov.uk/energy

- **develop a research programme dedicated to fuel cells to be funded jointly by EPSRC, DTI and the Carbon Trust;**
- **review the objectives of the DTI research and development programme;**
- **encourage UK organisations to work with the DTI's International Technology Service to identify potential partners and to participate in European collaborative research and development (R&D) projects including the EUREKA programme and to complement work by National Contact Points³⁸ to support participation in the EU's 6th Framework Programme;**
- **in collaboration with the EPSRC, review the supply of doctorates and MScs with the requisite skills; and**
- **working with the Carbon Trust, DTI's Small Business Service and Regional Development Agencies, support new start-ups in this sector.**



Fuel Cells UK

Interest in fuel cells across the world has never been higher as commercialisation draws closer. The UK has a significant number of fuel cell players but there is no established forum to enable the industry to come together and to raise its profile. Fuel Cells UK is being established to foster the development of a UK industry, to raise the profile of fuel cell activity in the UK, and to act as central liaison point for national and international activity.

Fuel Cells UK will become the first point of contact for information on UK fuel cell activities. It will develop and distribute relevant promotional material (including a UK capabilities guide) and will foster partnering by linking potential partners together. Its activities will be guided by a high-level steering group which will ensure that its activities have maximum relevance for industry.

Fuel Cells UK will work closely with existing and new initiatives across the UK to build synergies and optimise the outcomes for both the industry and other stakeholders (including Government). One such DTI initiative will be Fuel Cells Forum, a network for industry, academia, venture capitalists and Government stakeholders in fuel cells to exchange and disseminate information.

Fuel Cells Forum will enable organisations to highlight their activities, and for industry to pose challenges to the research community. The DTI's International Technology Service offers the possibility for stakeholders to identify and engage overseas partners and keep abreast of developments overseas.

³⁸ National Contact Points provide an information and assistance service for UK organisations seeking R&D support from the EU's Framework Programme for Research and Development.

Research is needed to give us new options for the longer term...

- 4.60 Technology will almost certainly surprise us in the field of renewables as elsewhere. **To expand the knowledge base we have already provided an extra £8 million to the Research Councils specifically for renewables research over the next three years. This is part of a new £28m investment in support of sustainable energy research.** The money will be spent on fundamental research into a range of technologies, consistent with the recommendations of the Chief Scientific Adviser's Energy Research Review Group.
- 4.61 We also need to support industry in taking the new ideas generated in the laboratory to the point where they can enter the market. We have increased the amount available to support industrially-led research and development through the DTI (£19m per year) and the Carbon Trust (£5m per year).

Renewables offer big opportunities for UK business...

- 4.62 The growth in the global renewables market offers considerable opportunities for UK companies to create jobs in manufacturing, services and supplies and to improve their export capabilities. The development of windfarms is already producing new jobs in manufacturing³⁹. Renewables UK will help to secure benefit for UK industry in the renewables market.

³⁹ The world's leading wind turbine manufacturer, Vestas, established a turbine manufacturing base at Campbeltown in the Kintyre peninsular creating 130 jobs. Cambrian Engineering is establishing a wind turbine tower and offshore pile manufacturing and assembly operation at Arnish in the Isle of Lewis, expected to create 65 jobs.

- 4.63 If the UK is to compete globally, projects need to move out of the R&D stage into commercialisation. We have a role to play in facilitating this. **Through Renewables UK we will develop by April 2004 programmes and tools to assist the UK renewables supply chain.**

Widening the renewables obligation certificate market...

- 4.64 The Northern Ireland Executive has recently brought forward an Energy Bill containing provisions to introduce a Northern Ireland Renewables Obligation. **We are considering with the Scottish Executive how we might devise a system allowing mutual recognition of Renewable Energy Certificates under the Renewables Obligation and those in Northern Ireland under their future Obligation.**

The international community has a role to play...

- 4.65 The World Summit on Sustainable Development (WSSD) took place in Johannesburg in August/September 2002. The Summit brought together 180 countries who reaffirmed the international community's commitment to sustainable development through action to provide access to clean water, sanitation and sustainable energy, and to protect biodiversity, the oceans, fish stocks and natural resources. The Summit agreed joint actions urgently and substantially to increase the global share of renewable energy sources.⁴⁰ At the Summit the Prime Minister announced that the UK's Export

⁴⁰ www.johannesburgsummit.org/

Credit Guarantee Department will make available £50m per year to renewable energy exports to developing countries. The Sustainable Energy Exports Committee will work to deliver this commitment. At WSSD, the UK also launched and is taking forward an international partnership to promote the growth of renewable energy and energy efficiency systems (REEEP).

A Renewable Energy and Energy Efficiency Partnership (REEEP)

REEEP aims to deliver our WSSD commitments on energy and take forward the recommendations of the G8 Renewable Energy Task Force for removing the policy, technical, market and regulatory barriers to renewable energy and energy efficiency.

Interested partners include governments from OECD and non-OECD countries, businesses, non-Governmental organisations and international agencies committed to accelerating the market development of renewable energy and energy efficiency technologies.

The partnership will focus on:

- state-of-the-art policies for power sector reform and building on best regulatory practice to promote distributed energy systems;
- innovative financing and tradable certificates for renewable energy and energy efficiency projects; and
- evaluation and awareness raising of the non-carbon reduction benefits of renewable energy such as energy security, rural development and export opportunities

4.66 **We will integrate the WSSD agreements and relevant follow-up into UK policy and action with a clear focus on the use of technological innovation to deliver sustainable development. We will work with like-minded states to promote the deployment of renewable sources of energy in developing countries, building on the initiatives launched at WSSD as well as encouraging investment in appropriate energy infrastructure.**

We do not propose new nuclear build...

- 4.67 As chapter 1 makes clear, our priority is to strengthen the contribution that energy efficiency and renewable energy sources make to meeting our carbon commitment. We believe that such ambitious progress is achievable, but uncertainties remain.
- 4.68 While nuclear power is currently an important source of carbon free electricity, the current economics of nuclear power make it an unattractive option for new generating capacity and there are also important issues for nuclear waste to be resolved. This white paper does not contain proposals for building new nuclear power stations. However, we do not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon targets. **Before any decision to proceed with the building of new nuclear power stations, there would need to be the fullest public consultation and the publication of a white paper setting out the Government's proposals.**

But we are not seeking to shut existing stations prematurely...

- 4.69 The financial problems of the private sector nuclear electricity generator, British Energy, are well known. These problems are about a company, not about the future of nuclear power. Our main objectives with regard to British Energy continue to be the safety of its nuclear power stations and the security of electricity supplies to the grid and consumers. British Energy's nuclear power stations will continue to generate electricity. And since the revenue from continuing to run those stations more than covers the avoidable costs of their operations, this revenue can be put towards paying for the nuclear liabilities that are already incurred and cannot now be avoided.
- 4.70 Under the company's restructuring proposal, announced on 28 November 2002, which is subject to the approval of the European Commission, we are taking on financial responsibility for the company's historic spent nuclear fuel liabilities. We are also, to ensure safety and environmental protection, underwriting new and enhanced arrangements by the company to meet decommissioning and other liabilities. On 14 February 2003, British Energy secured the agreement in principle of its financial creditors to its restructuring proposal.

Managing the Nuclear Legacy

Irrespective of decisions on future nuclear build, the legacy of nuclear waste has to be dealt with safely, securely and cost effectively in ways that protect the environment for current and future generations. We have announced our intention to make radical changes to arrangements for nuclear clean-up funded by the taxpayer. The white paper *Managing the Nuclear Legacy*⁴¹ set out proposals for a new authority, the Nuclear Decommissioning Authority (NDA), to deal initially with the historic liabilities already funded by the taxpayer, which represent 85% of total UK nuclear liabilities. The NDA will set a framework for a clean up programme over the long-term, securing best value for money consistent with high safety, security and environmental standards, and using the best available skills through competitive markets for clean-up contracts. Preparation for the necessary legislation is underway.

For nuclear sites outside the NDA remit, we will seek to ensure there are adequate resources set aside to provide for clean-up.

In 2001, the Government and the Devolved Administrations for Scotland, Wales and Northern Ireland published *Managing Radioactive Waste Safely*,⁴² a proposed programme of action for deciding how best to manage the UK's solid radioactive waste in the long-term. Having considered responses to the proposals, we announced in July 2002 that we would set up a new independent body to oversee a review of different ways of managing the waste, and to recommend a national strategy to Ministers. We hope to receive recommendations and announce the strategy by 2006.

41 July 2002, CM5552

42 *Managing Radioactive Waste Safely, 2001*
www.defra.gov.uk/environment/consult/radwaste/pdf/radwaste.pdf

Chapter 5 Clean Low Carbon Transport

Transport will contribute to carbon reductions...

- 5.1 The transport sector, including aviation, produces about one quarter of the UK's total carbon emissions. Road transport contributes 85% of this, with passenger cars accounting for around half of all carbon emitted by the transport sector.
- 5.2 The movement of people and goods will remain essential for economic success. Rising demand for transport reflects the priority which people attach to mobility. Transport is and will continue to be a highly-valued, high demand commodity.
- 5.3 But we can reduce the impact of transport on the environment through better, cleaner vehicles and fuels and by our action to reduce the negative impacts of traffic growth.
- 5.4 Measures for promoting a shift to low-carbon vehicles and fuels are brought together in our *Powering Future Vehicles*¹ strategy, published in July 2002. **That strategy is complementary to this white paper.** In the foreword to the strategy, the Prime Minister spelled out his objective that the UK should lead the global shift to the low-carbon economy, building competitive advantage for the UK's automotive industries as well as providing cleaner and better transport. We have set targets that within the next decade one in ten new cars sold in the UK will be low-carbon vehicles with emissions of 100 grammes per kilometre (g/km) CO₂ or less, and that one in five new buses will also be low-carbon. We have made the UK the first country to set itself targets for shifting its mainstream transport fleet to low-carbon technologies.

The *Powering Future Vehicles* (PFV) strategy

The PFV strategy provides a framework for decisions and action, aimed at promoting the development, introduction and take-up of low-carbon vehicles and fuels; and at ensuring the full involvement of the UK automotive industries in the new technologies.

The key components of the strategy are :

- to promote research, development and demonstration of new vehicles, fuels and fuelling infrastructure;
- to ensure that environmental, health and safety issues are dealt with;
- to ensure that new technical standards and testing procedures are promptly developed and put in place;
- to work proactively with EU and other partners on international issues and standards;
- to facilitate the quick and smooth development of new fuel distribution infrastructures;
- to ensure the continued development of appropriate taxation of low-carbon transport;
- in this and other ways, to encourage consumers' take-up of low-carbon vehicles and fuels, including financial measures and consumer information and awareness;
- to make maximum use of new vehicles and fuels in the Government and other public sector fleets;
- to work closely with all stakeholders in establishing the Low Carbon Vehicle Partnership; and
- to set challenging targets for making the UK a world leader in the move to low-carbon transport.

¹ *Powering Future Vehicles: The Government Strategy*. DfT, DTI, Defra and HMT, July 2002

5.5 Action at both UK and European level has already promoted significant technical progress and innovation in the automotive industries. We expect this progress to continue. Since 1990, the average carbon efficiency of new cars entering the fleet - the distance travelled for a given amount of carbon emitted - has improved by 10%. Cars have also become safer and cleaner, with air quality emissions down to one twentieth of what they were 20 years ago. These are important achievements. At the same time, strong economic growth and the high priority which people attach to mobility has led to increasing car mileage. The net effect is that total carbon emissions from car transport have been roughly flat.

5.6 The Transport Ten Year Plan² sets out a comprehensive programme of investment and innovation. The strategy focuses on addressing the negative impacts of congestion. It promotes increased use of public transport and a shift of goods traffic from road to rail, as well as sustainable patterns of land use. All help to reduce the need to travel and consequent environmental impacts. By 2005, we expect to see progress as a result of schemes to tackle traffic bottlenecks; a growing programme of new bypasses and other major road improvement schemes; better traffic management, helping to limit congestion on both motorways and in towns and cities; and increased use of public transport.

5.7 The Plan will be reviewed in 2004. The review will roll forward the Plan, setting out proposals for transport up to 2015 and will continue to take full account of our objective to reduce the environmental impact of transport.

Innovation will continue to improve vehicle efficiencies...

5.8 The EU voluntary agreements on new car fuel efficiency with the European, Japanese and Korean manufacturers have proved a highly effective mechanism for improving cars' fuel efficiency and reducing carbon emissions. They have provided manufacturers with a stable long term framework within which to plan, research and introduce fuel-saving innovations. This approach, which focuses on the levels of carbon emitted rather than on dictating particular technologies, gives manufacturers the flexibility to develop the best and most cost-effective solutions. The agreements are on course to reduce emissions from the average new car from 190g/km in 1995, the base year for the agreements, to 140 g/km by 2008 - a reduction of around 25%³.

5.9 **We strongly support this approach. We will work with the Commission in developing further voluntary agreements to continue the reduction in average new car emissions or other arrangements with the same objective.** We will draw on the expertise of the Low Carbon Vehicle Partnership in doing so.

5.10 In the UK we have backed the voluntary agreements with a supportive fiscal framework. We have moved to graduated Vehicle Excise Duty and Company Car Tax, both now linked to the car's CO₂ performance. This is encouraging car buyers to consider buying the lower-carbon vehicles coming into car showrooms. **We will keep transport taxes under review to ensure that they**

² *Transport 2010 - the Ten Year Plan*, Department of the Environment, Transport and the Regions, July 2000.

³ All figures relating to the voluntary agreements are for 'tank to wheel' emissions.

continue to provide incentives to encourage the early development and take-up of low carbon vehicles and fuels.

it has attracted international attention. A further call for projects is in progress, to deal with identified Roadmap priorities.

Vehicle taxation - supporting low-carbon choices

Before 1999, **Vehicle Excise Duty (VED)** was the same flat rate for all cars. VED for new cars is now graduated, linked to a car's CO₂ emissions. VED now ranges from £60 to £160, with zero duty for electric vehicles.

Company Car Taxation (the personal tax on private use of company cars) also shifted to a graduated, CO₂-linked basis last year. Tax is payable on a proportion of car list price, ranging from 15% to 35% for higher emission cars.

We are monitoring the impact of the shift to CO₂-related taxation on car buyers' choices. Diesel car registrations in 2002 - with their lower CO₂ emissions - were 38% up on the previous year, taking diesel's share of total new car registrations to 23.5%, compared with less than 5% in 1990⁴.

5.11 We are also supporting strategic automotive research and development through the *Foresight Vehicle* programme. Over 400 companies and organisations are involved in projects valued at £100m. Around one third of these projects relate to low-carbon vehicle technologies, including new powertrains, advanced electronics and advanced materials and structures. The *Foresight Vehicle Technology Roadmap*⁵ was developed in collaboration with industry, and identifies priority issues. Published in November 2002,

⁴ Society of Motor Manufacturers and Traders Analysis of 2002 car sales.

⁵ www.foresightvehicle.org.uk/initiatives/init01.asp

Foresight Vehicle Programme - Project Examples

HEART4EV

This project seeks to increase the efficiency of the gas turbines used to power hybrid vehicles. The current limitation of this technology is a reliable, low cost, highly effective air-to-air heat exchanger (known as a "recuperator"), used to recover energy from the turbine's high temperature exhaust gases and pre-heat the incoming air.

The project will result in the UK having a world leading, low-cost, durable and highly effective recuperator, for marketing worldwide. It will also open the way for future drivetrain programmes aimed at establishing the recuperated microturbine as an alternative to reciprocating internal combustion engines, with significantly lower fuel consumption and carbon emissions.

HERO

This project is investigating the application of parallel hybrid drivetrain technology in an off-road 4x4 vehicle. HERO demonstrates that the application of hybrid technology in the form of a "mild hybrid" can enhance both the performance and functionality of an off-road vehicle and reduce its environmental impact. This could significantly reduce exhaust emissions and allow the use of regenerative braking to make significant gains in efficiency.

LAMTRAK

This project is supporting another innovation - an infinitely variable ratio transmission device for use in vehicles - known as the Torotrak rolling traction variator - to increase fuel efficiency and reduce pollution.

LAMTRAK will assist Torotrak in meeting its target of 80% penetration of the world's automatic transmission market. The project will improve understanding of the elasto-hydrodynamics of friction reduction in thin lubricating films. This in turn will lead to increased application in vehicles, leading to greater fuel efficiency.

RHOLAB

The RHOLAB project aims to develop a novel lead acid battery incorporating thermal management, fault tolerance and safety features as a traction battery for hybrid vehicles. A battery pack must meet a specification that includes sensing, switching and thermal and electrical control devices in a way that does not jeopardise its manufacturability. As part of the project, the consortium will build a prototype pack that will allow the operation to be assessed while powering a hybrid vehicle.

CHOICE

This project will design, build and evaluate a diesel series hybrid city bus incorporating vehicle and passenger information systems.

The vehicle performance will be optimised in terms of exhaust emissions and fuel efficiency based upon a wide range of input information including current and predicted operational duty, actual measured performance and current and immediate route location. The platform for the project is the Dennis Dart SLF single deck 50-passenger bus, with latest access features for disabled passengers. The series hybrid powertrain will employ an engine from the passenger car sector, giving lower cost, better emissions performance and fuel economy, compared to conventional bus powertrain systems.

5.12 The creation of the Low Carbon Vehicle Partnership is an important component in the Powering Future Vehicles Strategy.

The Low Carbon Vehicle Partnership - (LowCVP)

LowCVP - an action and advisory group - will promote the UK's shift to low-carbon transport, help industry, consumers, environmental and other stakeholders to participate in the shift, and maximise the competitive advantage for UK businesses.

Launched in January 2003, the Partnership Board is made up of top-level executives of UK auto manufacturers, transport operators, consumer and environmental groups and the research and technology sectors.

Early projects will include:

- a collaborative programme involving bus manufacturers, operators and users in shifting the UK to low-carbon buses;
- a programme to build the UK component industry's capability in the design and manufacture of key components for new technology vehicles;
- advice to Government on the role and remit of the Centre of Excellence for Low Carbon and Fuel Cell Technologies, an initiative proposed by the Automotive Innovation and Growth Team (AIGT) now being taken forward by the Government;
- advice to Government on the setting of 2020 targets for ultra-low-carbon vehicles, including zero-emission vehicles, and on the priorities for government R&D programmes; and
- helping Government co-ordinate its low-carbon research development and demonstration activities and providing a 'single portal' for potential participants.

5.13 Work⁶ commissioned by the Department for Transport and the DTI indicates the scope for further reducing average new vehicle carbon emissions. It suggests that full-specification family cars with carbon emissions of 100g/km (equivalent to about 75 miles per gallon of diesel) or less may be achievable within the next two decades, in particular through hybrid and related vehicle technologies. As the Foresight Vehicle Programme projects show, (see box, page 66) this is an area of technology where the UK has a strong research, development and design presence.

6 *Carbon to Hydrogen Roadmap for Passenger Cars : A Study for DfT and DTI, Ricardo Consulting Engineering Ltd, November 2002.*

Hybrid vehicles

Hybrid vehicles use internal combustion engines in conjunction with electric battery power, to give increased efficiency, lower fuel consumption and lower CO₂ emissions. Hybrids usually incorporate energy recovery from braking systems, and eliminate engine idling in static traffic. This also reduces noise and urban pollution. Hybrid vehicles will increasingly have the capability to switch to electric-only driving for extended distances, giving zero tailpipe emissions for example when driving through Low Emission Zones.

We support take-up of hybrid cars with £1,000 purchase grants under the *TransportEnergy* programme, administered by the Energy Saving Trust. Hybrids also benefit from lower Vehicle Excise Duty and Company Car Tax.

Two hybrid cars are currently available in the UK - the Toyota Prius, a family saloon with CO₂ emissions of 120g/km⁷ and the Honda Insight, a two-seater car at 80g/km. A four-door Honda Civic hybrid will become available in early 2003, at 116g/km.

UK-based Ricardo Engineering Consultants have produced the *i-MoGen* - a demonstration hybrid diesel car, delivering full 1.8 litre diesel

performance with a 1.2 litre diesel engine. A number of global vehicle manufacturers and component suppliers are now applying *i-MoGen* technology in their future programmes.

We are supporting development and road demonstration trials of hybrid and other innovations through the Government's New Vehicle Technology Fund. Projects include a micro-turbine-engined bus developed by the Wright Group of Northern Ireland; two other hybrid bus projects being carried through by EA Technology and Environmental Transportation Systems; and an LPG-fuelled hybrid urban delivery van being developed by ENECO Ltd. Projects in the pipeline include several demonstration pilot diesel hybrid taxis.

Hybrid technologies provide direct and immediate benefits in reducing cars' fuel consumption, driving costs and carbon emissions. They also provide a stepping stone to the development of mass-market hydrogen powered fuel cell vehicles, since the electric traction and control systems used in hybrid vehicles will also be key components in fuel cell vehicles.



We can also reduce emissions through lower-carbon fuels...

- 5.14 Better cars will significantly reduce fuel use and carbon emissions. But we can also reduce the carbon intensity of transport by adopting fossil fuels that have a lower-carbon content. We already support the increased use of the well-established road fuel gases - LPG (Liquefied Petroleum Gas) and natural gas.

⁷ A car which has a fuel economy of 55mpg will emit 120g/km of CO₂

LPG and Natural Gas

We promote the wider use of these gases through lower rates of fuel duty, and through our *TransportEnergy* Programme, run by the Energy Saving Trust. This provides grants for the purchase and conversion of gas vehicles, and works together with the fuel industry on the fuels' availability on the road, and with vehicle manufacturers.

Starting from scratch in the late 1990s, **LPG** is now available nationwide from over 1,100 filling stations. The positive experience of LPG shows that, with industry and Government working together, major innovations in fuel technologies and distribution can be quickly and successfully carried through.

There are currently (February 2003) around 75,000 LPG cars in the UK. We have particularly encouraged manufacturers to develop off-the-shelf LPG car models, to make this fuel a mainstream showroom option for car buyers. Models are now available from eight manufacturers.

Natural gas is mainly used in heavy vehicles. Apart from lower emissions, the noise from gas fuelled engines is up to two-thirds lower than diesel engines, a useful environmental benefit in busy urban areas. *TransportEnergy* grants support the conversion or purchase of lorries, buses and utility vehicles. A major supermarket chain is in the process of converting its delivery fleet. Work with industry - vehicle manufacturers, users and fuel suppliers - continues with a view to encouraging wider take-up.

Our objectives for natural gas reflects the EU Commission's analysis of the future pattern of transport energy use, which identified natural gas - alongside biofuels and hydrogen - as an important component in widening fuel diversity and energy security in the transport sector.

- 5.15 And we are promoting the wider use of other alternative fuels - in particular biofuels - which have significantly lower lifetime carbon emissions. With the low duty rates being introduced, we estimate that biodiesel and bioethanol could account for up to 5% of total fuel use by 2020.

Biofuels for transport

Alongside renewably-produced hydrogen, fuels made from biomass represent an important potential route for achieving the goal of zero-carbon transport, creating new opportunities for agriculture in the UK as well as globally.

We have reduced the duty on **biodiesel** to 20 pence/litre below the standard (ultra low sulphur) diesel rate, and this fuel is now coming on to the retail market in increasing volumes in a 5% blend with conventional diesel. Some lorry fleets are also converting to 100% biodiesel fuelling.

As announced in the Pre-Budget Report in November 2002, we propose to introduce the same 20 pence/litre incentive for **bioethanol**, subject to EU agreement. This can also be used in blends for existing cars, potentially also as an 85% pure biofuel in adapted cars.

Biofuels are currently made from food crops. We are also interested in supporting the development of bioethanol and biodiesel production from biomass such as farm wastes, forestry residues, coppice crops and possibly also domestic waste. These can potentially deliver bigger carbon savings and wider environmental, farming and rural employment benefits.

A significant contribution to carbon reductions...

- 5.16 Taken together, the proposed continuation of voluntary agreements on vehicle carbon dioxide performance, increased use of biofuels and other initiatives could improve the carbon efficiency of transport by up to 10% by 2020. The carbon savings will increase further beyond 2020 as more fuel-efficient cars spread progressively into the fleet.

Ultimately taking us beyond fossil fuels, to a very low-carbon transport economy...

- 5.17 Although vehicle technologies seem capable of becoming twice as fuel-efficient as today's vehicles, deeper carbon reductions will need low-carbon fuels - either hydrogen (generated from non-fossil sources) or biomass-based liquid fuels.
- 5.18 The auto industry generally expects hydrogen powered fuel cell cars to move towards mass-marketing around 2020. This timetable ties in with the findings of a recent investigation⁸ carried out for us by environment and energy experts from three leading UK environmental organisations, the Energy Saving Trust, the Institute for European Environmental Policy and the National Society for Clean Air. This study indicates that the greatest carbon savings from early non-carbon electricity will come from its use to displace more carbon intensive electricity generation rather than from its use for transport energy. This suggests that the major environmental benefits from a shift to

the large-scale use of hydrogen-fuelled vehicles will come at the point when surplus low-carbon energy becomes available.

- 5.19 But on a longer-term time scale, hydrogen use in transport has major potential for decoupling transport and carbon, if current technological and cost barriers can be overcome. **We are is therefore supporting research, development and demonstration programmes (including vehicles and fuelling infrastructure) to overcome the initial market barriers to the development of this technology.** The Chief Scientific Adviser's Energy Research Review Group recognised that hydrogen production and storage was a key research area.

⁸ *Fuelling Road Transport - Implications for Energy Policy*, by Nick Eyre, Malcolm Fergusson and Richard Mills, November 2002.

Hydrogen, transport and future energy systems

Hydrogen looks likely to play a key role in future low-carbon energy systems, as an 'energy carrier' through which non-fossil energy can replace fossil fuels in stationary power units such as domestic fuel cell based CHP units and in vehicles. Hence the very wide interest in the prospective shift to a future 'hydrogen energy economy'.

Hydrogen fuelled vehicles have zero tailpipe emissions - they emit only water vapour at the point of use, improving local air quality. They will also be low-noise. Industry experts agree that buses, utility vehicles and similar depot-based fleets are likely to be candidates for the early trialling and introduction of hydrogen fuel cell technology, since larger vehicles can handle hydrogen fuel tanks more easily and need only depot supply of the fuel.

There is considerable international interest in developing hydrogen for transport. In the USA, increased funding for research and development into hydrogen-powered vehicles was announced in the 2003 State of the Union address. The aim is to take hydrogen powered vehicles from the laboratory to the showroom within a generation, and to develop hydrogen production, storage and distribution technology. This is expected to create further opportunities for US-UK collaboration.

Hydrogen can be produced from a wide range of sources, including hydrocarbons, biomass and wastes, or the electrolysis of water. But these sources must themselves be non-fossil for hydrogen vehicles to deliver their full lifecycle carbon benefits.

Hydrogen seems likely to play a key role in future transport technologies. We are supporting the shift by:

- exempting hydrogen from road fuel duty for a period to encourage its early development and take-up;
- granting Enhanced Capital Allowances with a 100% first-year write-down for investment in hydrogen fuel infrastructure;
- supporting fuel cell research (see paragraphs 4.59-4.60);
- giving hydrogen projects a high priority in the Carbon Trust's Low Carbon Innovation Programme;
- funding the trialling of fuel cell buses by Transport for London in 2003 and the supporting hydrogen fuelling station being installed by BP;
- supporting the trialling of fuel cell cars as these come out of car-makers' design laboratories; and
- working with London and other local and regional organisations on a wider network of demonstration trials, including linkages with existing local hydrogen distribution networks such as that on Teesside. We will encourage projects that can demonstrate hydrogen production in combination with other carbon abatement technologies.

A low-carbon economy needs to be planned for...

- 5.20 We expect both hydrogen and biomass fuels to play major roles in a very low-carbon transport economy, with benefits also in terms of improved energy diversity and security. But significant use of hydrogen for transport has profound implications for the long-term demand for non-fossil electricity as well as for future energy infrastructures, including electricity and gas. Equally, significant use of biofuels for transport has major implications for biomass production, fuel production, and fuel distribution - as well as for the rural economy and agriculture.
- 5.21 We need to adopt a strategic approach to both these important new technologies, bringing together the prospective uses of hydrogen and biofuels in transport with other aspects of the energy system. We need to understand more about the options and technologies for hydrogen and biofuel production. And we need a clear vision of the way in which infrastructures can evolve in good time. With industry, we also need to reach a common understanding of the likely trajectory to the availability of affordable hydrogen vehicles. **Drawing on the Low Carbon Vehicle Partnership and other expert knowledge, we will over the next year produce an assessment of the overall energy implications of both a hydrogen economy, and of large-scale use of biomass-based fuels, and develop roadmaps of the possible transition to these new fuels and vehicles.**

We need to reduce the emissions from aviation...

- 5.22 Demand is rising in the aviation sector internationally at about 4% a year. We all benefit from the growth in business, services and our ability to travel. International aviation emissions currently do not count in the national inventories of greenhouse gas emissions. There is no international agreement yet on ways of allocating such emissions. The UK's international emissions currently amount⁹ to some 8MtC (9MtC including domestic). They are expected to rise to some 14-16MtC by 2020.
- 5.23 **We are committed to ensuring that the long-term development of aviation is sustainable and that it meets its external environmental costs. We are discussing with stakeholders the most economic instruments for ensuring that the industry is encouraged to take account of, and where appropriate reduce, its contribution to global warming. We will set out our plans in an Air Transport white paper.** Potential instruments to address CO₂ emissions from international aviation being considered internationally include an en route emissions charge and participation in an open emission permit trading system. For domestic flights British Airways has joined the UK emissions trading scheme. These may be opportunities for future participation in this scheme for other carriers who operate UK-based routes.

⁹ UK aircraft CO₂ forecasts for 2030 are reported in Annex E of : *The Future Development of Air Transport in the United Kingdom: South East*. Department for Transport, July 2002 and February 2003.

Reduced emissions from the other transport modes, such as shipping...

- 5.24 Other transport modes account for much smaller amounts of energy and carbon but can contribute useful reductions. Like aviation, shipping is international in nature and in its oversight. The UK supports the work of the International Maritime Organisation (IMO) to put in place a global strategy for reducing greenhouse gas emissions from ships. An IMO Working Group is working on both technical improvements to engines, onboard machinery, hull and propeller design, and also working on operational and market-based measures such as environmental indexing of ships, voluntary agreements, emission standards and emission trading. The Working Group will put forward a draft resolution on the strategy at the IMO Assembly this year.
- 5.25 On the domestic shipping front we are working to reduce carbon emissions from domestic freight transport by encouraging a switch from road to other modes. Freight Facility Grants support freight owners and carriers in switching traffic from road to inland waterways and this programme has now been extended to coastal freight and short sea shipping.

And rail...

- 5.26 Rail transport carbon emissions, accounting for less than 1% of total UK emissions, are typically about half those for road-based modes per passenger or tonne per kilometre. Investment in rail infrastructure will help to reduce overall carbon emissions by supporting the shift in passenger and freight transport from roads and domestic aviation. New rolling stock on the network is also more energy efficient, further helping to improve carbon performance.

Section Three

Reliable, competitive and affordable supplies

Section Two of this white paper outlined our proposals to move to a low carbon economy and explained how energy and environmental policy will in future be better integrated. As we outlined in the first chapter, we also have three other goals that we believe can be achieved simultaneously alongside action to reduce carbon emissions - reliability of supply, competitiveness and affordable heating and lighting in every home. These are dealt with in turn in the next three chapters.

Chapter 6 Energy reliability

- 6.1 Our goal is that people and businesses can rely on secure supplies of energy - gas, fuel and electricity - at predictable prices delivered through the market. Reliable energy supplies are an essential element of sustainable development.
- 6.2 To achieve this we need a resilient energy system, without significant weaknesses, which works well and which recovers quickly if problems occur. This means a diverse system based on a mix of fuel types, a variety of supply routes, efficient international markets, back-up facilities such as storage, and a robust infrastructure. Developing low carbon options will also create opportunities further to increase energy reliability¹.
- 6.3 Reducing demand also helps energy reliability. Demand can be reduced through better energy efficiency (as described in chapter 3). Technologies and pricing structures that enable and encourage users to manage their electricity and gas demands away from peak periods also help. Reliability can also be enhanced by decreasing our dependency on imported fossil fuels, eg by investing in technologies which will enable us to diversify our fuel options.
- 6.4 Energy reliability raises issues on a number of time horizons. We need short-term contingency plans against the possibility of geopolitical instability, terrorism, major technical problems and extreme weather conditions. The UK energy system has proved robust. But we cannot at anything like a reasonable cost completely eliminate all risks of supply disruption, for example during extreme weather conditions. We also need long-term strategies to secure sufficiently diverse fossil fuel sources as the UK becomes, over the next two decades, a net energy importer rather

than exporter. And we need to rise to even longer-term challenges in reconciling the use of energy with long-term environmental objectives, both domestically and overseas.

- 6.5 In preparing this white paper, we have considered these issues carefully. The energy supply risks that we face are important. But we believe they are manageable. Our new arrangements for monitoring energy security have given us better information on risks and opportunities and on the markets' response to them. Energy markets are already responding². Our role is continually to monitor developments, and to create a competitive market place, including through good international relations, within which liberalised markets will deliver energy reliability.
- 6.6 Our strategy is based on the following principles:
- the regulatory framework must give high priority to reliability. OFGEM and the Government both have duties to secure that all reasonable demands for electricity and gas are met. **OFGEM has agreed that in future it will report on how its regulatory activities impact on energy security;**
 - diverse sources, fuel types and trading routes should be promoted to avoid the UK being reliant on too few international sources of oil and gas. **We will work with producer nations and the private sector to promote the conditions needed for investment in energy infrastructure;**

¹ The term energy reliability is taken to encompass all aspects of energy security; the words reliability and security are used interchangeably in this chapter.

² For example, in the past year contracts have been signed, or definite interest expressed, for additional gas supplies and new infrastructure projects. These are diverse and include Centrica contracting with Statoil and Gasunie to import natural gas, Exxon-Mobil with Qatar for LNG, increased compression on the interconnector at Zeebrugge, and proposals for new LNG terminals at Isle of Grain and Milford Haven.

- liberalised energy markets are a cornerstone of our energy policy. Competitive markets incentivise suppliers to achieve reliability. For example, suppliers will diversify their own sources to reduce their commercial risks, thus contributing to wider diversity.
We will continue to work to create an effective policy and regulatory framework for the market, both nationally and at European and international levels; and
- we need robust information on supply and demand and market responses to it.
We will therefore give high priority to our new monitoring arrangements to track all aspects of energy reliability.

6.7 For the markets to work, firms need to be confident that the Government will allow them to work. Energy supply problems in other countries have demonstrated the risks of not doing so. **We will not intervene in the market except in extreme circumstances, such as to avert, as a last resort, a potentially serious risk to safety.**

6.8 Our perception and understanding of terrorist threats changed on 11 September 2001. Since then we have improved and will continue to improve our contingency planning and resilience in dealing with major incidents. This applies especially to the energy sector, which along with other areas of our critical infrastructure is vital to the every day needs of industry and the public alike. Measures outlined elsewhere in the white paper to promote distributed generation and renewables will add to the diversity and robustness of the energy system.

Short-term reliability issues...

6.9 Energy security is a shared responsibility. OFGEM and the Government have duties, in carrying out their primary function of protecting the interests of consumers, to secure that all reasonable demands for electricity³ are met and to secure a diverse and viable long-term energy supply. OFGEM does so through for example setting licence conditions on industry participants and the price reviews of the monopoly infrastructure providers. The aim is that, should energy supplies be disrupted or energy demand exceed expectations in the short-term, the problem could be swiftly resolved.

Meeting peak gas demand

On 7 January 2003 GB gas demand reached a new record high of around 5 million MWh (450 million cubic meters). This level of demand is 5% higher than the previous maximum in 2002 but still only represents 85% of the potential peak day demand (a demand that is expected in 1 year in 20) that Transco has to ensure that the gas network can cope with.

6.10 Energy consumers, the market and Government need reassurance that the regulator is giving sufficient weight to energy security in proposing or making new regulations. OFGEM has agreed that in future its consultation documents will explain how its proposals will affect energy security as well as their impact on the environment and our social objectives.

³ For gas: the need to secure that, so far as it is economical to meet them, all reasonable demands in Great Britain for gas conveyed through pipes are met.

6.11 Where short-term problems arise we will continue, where appropriate with OFGEM, to evaluate what has happened and act accordingly. For example:

- the storms of 27 October 2002 were severe in some parts of the country and many households were without electricity for over a week. We considered the response of some of the electricity companies inadequate and immediately launched an investigation by engineering consultants into the resilience of the networks themselves and the response by the companies to the emergency. The report⁴, published in December 2002, confirmed that those companies which had carried out effective network maintenance and which had anticipated the storms well suffered fewer incidents and reconnected customers more quickly. We are considering along with OFGEM and the industry the best means of ensuring that the recommendations made in the report are implemented; and
- following the fuel protests in September 2000 we signed a Memorandum of Understanding with oil industry companies, the police, the Trades Union Congress, the Cabinet of the National Assembly for Wales and the Scottish Executive which sets a framework to improve co-operation and co-ordination between the key organisations in the event of a threat to oil supplies. We are now reviewing with the industry and other stakeholders the detailed plans for tackling oil emergencies and updating them in the light of developments in the economy.

Long-term challenges...

- 6.12 We have analysed closely the issues relating to future energy reliability. This analysis broadly supports that of the PIU which led to the conclusion that increased dependence on gas was not of itself a pressing problem. But safe and reliable supplies of electricity and gas are fundamental to our economy and way of life. We must therefore constantly monitor developments.
- 6.13 As a country we have been a net exporter of energy, with significant imports and exports, for the past two decades following the successful development of North Sea oil and gas. But this will change. Forecasts vary but it is commonly agreed that UK oil and gas production will decline significantly over coming years. We are currently working with the industry⁵ to maximise the economic potential of our North Sea supplies (see paragraph 6.37). But it is still likely that the UK will become a net importer of gas on an annual basis by around 2006 and of oil by around 2010. By 2020 we are likely to be importing around three-quarters of our primary energy needs. And by that time half the world's gas and oil will be coming from countries that are currently perceived as relatively unstable, either in political or economic terms.
- 6.14 Relying on imports need not be a problem in itself. Oil and - currently to a lesser extent - gas are internationally traded commodities. And all countries, whether import-dependent or not, have a common interest in promoting open markets and predictable prices. Most other advanced industrial economies

⁴ *Power system emergency post-event investigation* - www.dti.gov.uk/energy/domestic_markets/security_of_supply/index.shtml

⁵ The PILOT initiative.

already import significant proportions of their energy needs without noticeable disruption. Import dependency has long been a fact of life for all the G7 countries apart from the UK and Canada.

- 6.15 World wide fossil fuel resources are very large. Oil is the world's most important fuel, accounting for 40% of global primary energy consumption.⁶ Its share in 2020 is likely to be at a similar level. Globally, conventional oil reserves are sufficient to meet projected demand for around 30 years⁷, although new discoveries will be needed to renew reserves. Together with non-conventional⁸ reserves such as oil shales and improvements in technology, there is the potential for oil reserves to last twice as long. Proven gas reserves would meet at least 45 years of demand and there remains vast potential beyond this. That there is no shortage of oil and gas resources globally means that supplies are unlikely to be disrupted for long. But just as today, there will be risks of price shocks resulting from geopolitical disruption or damage to infrastructure in the short-term. These risks need to be monitored and managed.

International risks...

- 6.16 Moving from being largely self-sufficient to being a net importer of gas and oil requires us to take a longer term strategic international approach to energy reliability. We need continually to monitor and to manage the following international risks, while at the same time deepening international co-operation:

6 IEA World Energy Outlook 2002

7 IEA World Energy Outlook 2002

8 Oil not produced from underground reservoirs, for example oil shales, oil sands, extra heavy crude, etc.

■ **insufficiently diverse sources of fossil fuels.**

We should avoid becoming reliant on too few international sources of oil and gas; and

■ **global anti-competitive practices and illiquid markets.**

Competitive and liquid global markets, with oil and gas traded freely are the most effective way to help deliver more stable energy prices and for us to purchase what we need at any time.

We explain in the following paragraphs how we will mitigate these risks.

Diversity in gas markets...

- 6.17 Norway has been and is likely to remain a key provider of gas to the UK, and the Netherlands may become a more important supplier of gas to Western Europe. The world's largest gas reserves are to be found in Russia, the Middle East and Africa. Russia has the largest gas reserves, with around a third of the world's total⁹ and has been exporting gas to Western Europe for over 30 years without interruption. Many other countries offer potential supplies of gas including Algeria, with a long track record dating back to the late 1960s of providing gas to Europe, and countries in the Caspian region, North and West Africa and the Middle East (in particular Iran and Qatar).

- 6.18 **We are putting in place a new treaty with Norway** to facilitate continued supplies of gas - as a primary fuel and as a source of feedstock for the UK chemical industry - and to simplify cross-border developments, which will enhance the UK's production from the North Sea.

9 BP Statistical Review of World Energy

- 6.19 Our priority has to be to bring diverse supplies on-stream and into the EU market. Substantial long-term investment is needed to build the necessary infrastructure. For example some estimates¹⁰ suggest that investments of US\$170 billion may be required to develop gas production in Russia alone to 2020. While the total sums are large there is already evidence of the market expanding export routes, for example through the development of the North European Pipeline which would provide a much more direct route for Russian gas to the UK. The private sector has an incentive to undertake the necessary investment but given the scale of the infrastructure investments required and the long investment lead times **we will continue to monitor infrastructure development and international gas markets closely and support efforts to encourage investment (e.g. by promoting stable financial regimes and working with IFI's¹¹ to support project financing).**
- 6.20 Companies importing gas into the UK have a strong commercial interest in diversifying their own risks by having supply contracts with a number of different suppliers and by encouraging the development of appropriate infrastructure. The number and diversity of participants in the UK gas market is also making a valuable contribution towards expanding arrangements for future supply of gas into the UK. **To support the creation of an economic environment conducive to investment we will continue to engage with Russia, Iran, the Caspian, Middle East and African countries and the potential transit countries, focusing on good governance and the development of stable investment and transit regimes.**
- 6.21 Liquefied Natural Gas (LNG) offers a flexible alternative to piped gas. International trade in LNG is growing at about twice the rate of pipeline gas. This may over time lead to greater price convergence between regional markets given the increasing scope for arbitrage. The development of LNG import facilities in the UK will need additional onshore pipelines in some locations. This is being actively considered by Transco. It is possible that gas imports from some sources, particularly LNG, will vary in energy content and may require blending with other gases in the system, special processing on import, or the modification of certain gas appliances. **We will keep developments here closely under review. In particular we will monitor the likely effects on gas quality. In general we welcome the expansion of the LNG market as a contribution to diversity and security and as a source of competition to piped gas.**
- 6.22 The development of a gas cartel amongst pipeline gas and LNG producers could undermine long-term price security. **We will work with the European Commission and other member states in monitoring the situation closely, maintaining and developing a dialogue with exporting countries, encouraging diversification of gas supplies to Europe and addressing any emerging risks.**
- Diversity in oil markets...**
- 6.23 The bulk of world oil reserves are found in the Middle East, with Saudi Arabia alone holding around a quarter.¹² The other major Gulf producers hold as much again. Other significant reserves are found in South and

10 IEA, 2002

11 International Financial Institutions

12 BP Statistical Review of World Energy

Central America, Africa, Russia and the Caspian Basin. In addition to conventional oil reserves there are also massive unconventional oil reserves¹³ in Canada and Venezuela. The costs of production have fallen rapidly for these reserves but they remain higher than those of conventional oil. They also tend to be of poorer quality but can be upgraded.

To monitor trends in international oil markets and prepare for risks and uncertainties we will enhance our existing arrangements to monitor oil security issues. This work will be led jointly by the DTI and the FCO.

6.24 Oil stocks can contribute to resilience in the event of actual or potential supply disruptions. But they are unlikely ever to be large enough to act as a lever on oil prices. The International Energy Agency (IEA) is the key organisation for managing oil supply disruptions and the release of stocks by its members, including countries such as the USA and Japan in addition to EU members. As the proportion of world oil consumed by non-IEA members increases, it will be important for the IEA to establish a dialogue with key consumer countries, such as China and India, on the importance of oil security arrangements, the role of the IEA and how these countries could develop a closer relationship with the IEA. The intention would be that this process would lead to these countries developing an oil security framework that worked alongside, and complemented, that of the IEA. **We will continue to support the work of the IEA in encouraging members and non-members to maintain and develop oil security arrangements for use in the event of oil supply disruptions.**

13 See footnote 9

International Energy Agency (IEA)

The IEA - an OECD forum - plays an important role helping to ensure stable energy markets. Originally formed to oversee its members' oil emergency arrangements (described above), it is now also a policy forum for analysis, sharing best practice and technical collaboration in energy. Its committees review the energy policy of both member and non-member countries and long-term issues such as regulation, security of supply and the environment as well as R&D, technology, oil markets and emergency preparedness.

6.25 Like other importers, our dependence on OPEC¹⁴ for our oil supplies is likely to increase in the long-term. Supplies from other sources such as Russia, the Caspian Basin and West Africa will remain important and will add to diversity in the short and medium term. **We will continue to promote good relations with key existing and new suppliers in the Middle East, Russia, the Caspian and Africa. In particular we will continue to work to increase the transparency, diversity and liquidity of the world oil market and to improve the investment climate in key producing countries.**

Ensuring an effective EU market...

6.26 Oil is an internationally traded commodity. This is not yet true to the same extent for gas. We therefore need to work to ensure the development of liquid international gas markets. Our first priority is to work for fully competitive gas (and electricity) markets

14 Members are: UAE, Venezuela, Saudi Arabia, Kuwait, Iran, Libya, Nigeria, Algeria, Indonesia, and Qatar. Iraq is also a member but remains outside the group's quota agreements, as the country is still under sanctions resulting from the aftermath of the 1990-1991 Gulf War.

within the EU. The energy liberalisation package we instigated, which was agreed by EU energy ministers on 25 November 2002 (subject to co-decision procedure and approval by the European Parliament), is a major step towards this. It includes a commitment to allow industrial and commercial electricity and gas consumers a choice of supplier by 1 July 2004 and all consumers this choice by 1 July 2007.

6.27 The new liberalisation directives require the legal separation of transmission and distribution from production and supply and access to grids and downstream pipelines on published non-discriminatory terms. These structural measures are essential to achieving properly functioning internal EU markets. This will benefit consumers in terms of prices, efficiency, choice and service levels.

6.28 The directives also require member states to establish independent economic regulators - such as OFGEM in Great Britain - with specific duties in relation for example to transmission and distribution access tariffs and the allocation of interconnector capacity to third parties on a transparent and non-discriminatory basis. These steps will make a major contribution to the reliability of our energy supplies in the long term.

6.29 We have been pressing for these changes for a number of years. **We will now work with the Commission and with other member states to make sure the agreement is effectively implemented. We will also continue to press the Commission to tackle competition issues vigorously.**

6.30 In the longer term **we will work within the EU to encourage greater links between the EU market and supplies beyond its borders.**

Around 70%¹⁵ of global gas reserves are within economic distance of the EU market. Accessing these resources will increase the diversity and resilience of our own gas supplies.

Encouraging international co-operation...

6.31 Producers and consumers have a common interest in ensuring effective trade in energy products. Both benefit from stable markets that help ensure that supply is sufficient to meet demand and thus contribute to relatively stable global prices.

6.32 For over a decade oil and gas producing and consuming countries have been engaged in dialogue on both a bilateral and - through the International Energy Forum - on a multilateral basis. The UK has been an active supporter and participant. The dialogue has helped improve mutual understanding, confidence and awareness of long-term common interests as well as promoting the development of specific initiatives such as the Oil Data Transparency exercise. As trade in energy increases and the interdependence between new and existing oil and gas producer and consumer countries deepens, such dialogue will become more and more important.

6.33 Sustainable energy solutions also have the potential to strengthen energy reliability worldwide. **We will work to promote the deployment of renewable sources of energy in developing countries** (as covered in chapter 4) **as well as encouraging investment in appropriate energy infrastructure.**

¹⁵ *BP Statistical Review of World Energy*. Based on proven reserves in countries currently exporting gas to the EU.

6.34 Across departmental boundaries we need to give greater prominence to strategic energy issues in foreign policy. Both in the UK and through its network of overseas posts **the FCO will work more closely with other government departments to achieve common objectives in international energy security**. Our aims are to maintain strong relations with exporting countries and to promote the benefits - to both producers and consumers - of transparent, liquid, and liberalised world energy markets and diverse supplies of energy. In promoting diversity we will also work to minimise the risk of disruption to supplies from regional disputes or local instability and to promote sustainable approaches to energy reliability issues.

6.35 **To this end, we will continue to work with consumers and producers and with the international community to:**

- promote regional stability and economic reform in key producing areas;
- improve mutual understanding and the functioning of world energy markets, for example through continued improvements to international data transparency;
- promote conditions for Foreign Direct Investment through stable financial regimes, transparent legal frameworks, predictable domestic energy policies and predictable foreign investment terms;
- promote liberalisation of energy markets including through the World Trade Organisation (WTO), the IEA and the Energy Charter Treaty;
- work with other large consumers such as China and India to encourage more effective management of energy demand through energy efficiency improvements;

- work with IFIs to support financing for energy infrastructure investment;
- work with OECD partners and the international oil companies to promote sound economic development, particularly among the emerging oil and gas producers in Africa and Central Asia, for example through the Extractive Industries Transparency Initiative multi-stakeholder coalition; and
- through the FCO develop an Environment Attachés network to follow up on the Kyoto Protocol and other sustainable policies, extend the Science and Technology Attaché network, and engage key posts in promoting UK policies and reporting developments relevant to the international oil and gas markets.

Domestic issues...

- 6.36 In addition to the international risks there are potential risks to energy reliability within the structure of our own market. These are that:
- the economic potential of our oil and gas reserves is not maximised;
 - electricity generation companies will not invest in new capacity in sufficient time to meet future needs;
 - our sources of electricity generation may become insufficiently diverse;
 - supplies, particularly in gas markets, may not be sufficiently diverse and flexible; and
 - potential short term disruption may arise from financial difficulties among network operators.

We examine each of these risks in turn below.

The UK energy industry

The UK is home to a number of world class energy companies and companies specialising in all aspects of the energy sector. The UK has expertise ranging from niche extraction techniques and offshore engineering, to cutting edge renewable energy and environmental protection technologies.

We greatly value the contribution that these companies make to the UK economy and to our wider international goals. We will work with our companies to ensure that their international investments continue to make important contributions to economic development, good governance and political stability in key producer states.

We will also continue to work with the industry (for example within PILOT - see below) to maintain the UK's energy networks and to manage the UK's domestic resources to maximise economic and security of supply benefits.

Maximising our oil and gas reserves...

6.37 We are committed to maintaining an active and successful oil and gas industry in the UK, and to promoting future development of the nation's oil and gas reserves. The sector is and will remain important to the wider UK economy in terms of jobs, investment and its contribution to national income. We are keen to continue to encourage investment in both existing and new fields. The PILOT initiative is central to this aim.

PILOT

Now in its third year, the PILOT initiative is promoting industry co-operation with Government to enhance recovery of the UK's oil and gas resources and so prolong indigenous supplies.

PILOT's specific vision targets for 2010 are to:

- prolong self-sufficiency in oil and gas for the UK;
- maintain production levels of 3 million barrels of oil equivalent per day;
- sustain investment levels of £3 billion per year;
- deliver a 50% increase in the value of industry-related exports by 2005 (from 1999 level);
- bring additional revenue of £1 billion from new businesses;
- sustain 100,000 more jobs than there would have been; and
- ensure that the UK is the safest place to work in the worldwide oil and gas industry.

Specific activities to maximise recovery include stimulation of activity through the review of fallow acreage and fallow developments, promoting trading assets between operators, co-operative work to enhance brownfield developments and the promotion and sharing of best practice.

6.38 The 2002 Finance Act introduced important changes to the UKCS fiscal regime. It put in place a stable regime for the future which will raise a fair share of revenue on North Sea producers' profits while promoting long-term investment. The balanced package - the introduction of 100% investment allowances and a 10% supplementary charge on oil production profits on 17 April 2002 and the abolition of royalty on older fields from 1 January 2003 - puts the fiscal regime on a sustainable, long-term basis. New fields now enjoy one of the most favourable tax regimes

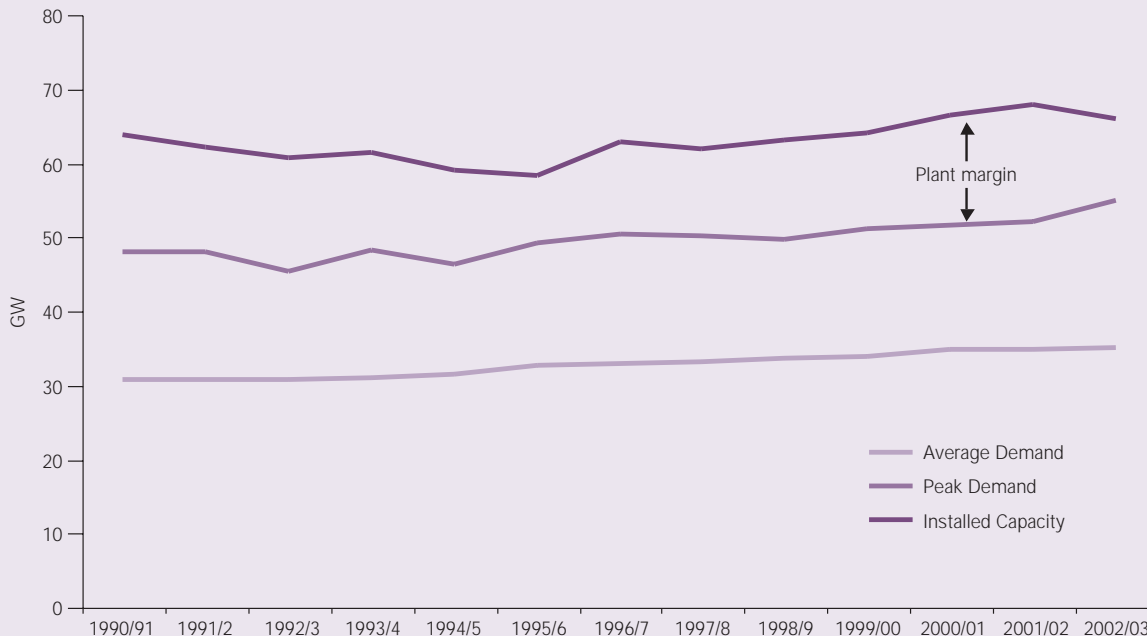
amongst major oil producing countries, along with all the other advantages of political stability, open and competitive markets, access to a skilled workforce and an extensive oil and gas infrastructure.

Ensuring incentives to invest in electricity generation...

6.39 Electricity cannot yet be stored economically in large quantities. We therefore need to have sufficient spare capacity to deal with variations in supply or demand, especially at times of peak demand. This is the plant margin¹⁶.

It enables the system to respond reliably and quickly to unexpected peaks in demand or unexpected interruptions in generation. In 2001/2 the installed plant margin in England and Wales was around 27%¹⁷ falling to around 20% in 2002/3¹⁸. Chart 6.1 below shows the plant margin over the past decade. The decline has been partly due to plant being mothballed. Recently mothballed plant could be returned to service at relatively short notice and low cost if required. In future, measures to make demand more flexible, for example through new metering technology, may mean that a smaller margin could provide the same level of security.

Chart 6.1
Installed Capacity and Electricity Demand, England and Wales



Source: NGC. 2002/3 data are provisional to date, average for 2002/3 is DTI estimate

¹⁶ Installed Plant Margin is defined as (Installed Capacity - Peak Demand)/Peak Demand and is expressed as a percentage.

¹⁷ NGC Seven Year Statement Update January 2002. Since 1990/91 the installed capacity margin has varied between 18% and 32%.

¹⁸ NGC Seven Year Statement Update January 2003. The margin in Scotland is currently 28%.

- 6.40 Wholesale electricity prices have been low recently. This is a result of the considerable increase in investment in generating capacity following higher prices in the 1990s. Recent prices are lower than many companies anticipated and some of them have found themselves in financial difficulty. Given current prices and the amount of existing capacity available there is currently no need or incentive for significant investment in new generation plant apart from renewables. These are not market failures. They are proper market responses. But some people have expressed concern about the longer term prospects for investment.
- 6.41 Over the next 20 years almost all our existing nuclear power stations will close as they end their operating lives. Most existing coal-fired power stations will also close as they age and as environmental controls become more stringent. There is inevitably a good deal of uncertainty as to the type and location of stations that will replace existing capacity as market participants respond to evolving price signals. But given current levels of capacity, including mothballed plant, and our expectations of growing renewables generation and energy efficiency improvements over the coming years, we are unlikely to need significant new investment in non-renewable power stations over the next five years or possibly longer.
- 6.42 A number of electricity markets elsewhere employ a form of capacity margin instrument (CMI) to seek to secure a fixed level of capacity margin, often to counteract the effect of price caps imposed elsewhere in their electricity markets. We have reviewed the case for such a measure here¹⁹.
- 6.43 We have concluded that the case has not been made for such an instrument in the UK market. The UK market already provides strong financial incentives for suppliers to contract for sufficient power. We also note that experience with CMIs in other countries has been mixed. Some have been subject to material alterations within short time periods the very sort of regulatory risk that the instrument is supposed to offset. NERA also estimated that a CMI could increase costs to consumers by some £150 million per year.
- 6.44 Licence conditions on NGC²⁰ and electricity suppliers²¹ also play an important role in maintaining security. OFGEM enforces licence conditions, a breach of which can lead to financial penalties of up to 10% of turnover. OFGEM can also modify licence conditions, or put new ones in place, with the agreement of electricity industry participants or after reference to the Competition Commission. **We will look to OFGEM to use its powers vigorously to apply and enforce appropriate licence conditions.**
- 6.45 OFGEM has confirmed that it considers that the current statutory framework, including the duties and functions set out within the relevant Acts and contained within related documents such as the Grid Code, is sufficient to help ensure the security of the balancing of the electricity transmission system. **Through JESS²² we will keep this under review.**

19 NERA study: *Security in Gas and Electricity Markets*, October 2002. NERA study: *Electricity Markets and Capacity Obligations*, December 2002.

20 For example National Grid Company has a licence condition to promote the security and efficiency of the electricity generation, transmission and distribution systems in England and Wales.

21 Electricity suppliers are required to take all requisite steps, so far as is reasonably practical, to secure the necessary supply of electricity.

22 The DTI/OFGEM Joint Energy Security of Supply Working Group.

6.46 In addition, OFGEM has agreed to publish a report every six months on the performance of the electricity and gas industries in delivering security, detailing any issues which have given rise to energy reliability concerns and saying what, if any, actions had been taken or might be needed to address those issues in future. These reports will be in addition to the forward looking security monitoring role of JESS.

A diverse mix of electricity generation...

6.47 Some people argue that the UK Government should specify the mix of fuel sources in electricity generation, allocating a proportion to gas, a proportion to coal and so on. We have considered this proposition carefully and have dismissed it. In our view Government is not equipped to decide the composition of the fuel mix used to generate electricity. Our preference is for a market framework with the right regulatory framework.

6.48 But neither should we allow ourselves to become overly dependent on any one fuel source across the whole economy or in a specific sector, such as electricity generation. It is our view that the policies we put forward in this paper will encourage the long-term development of new, more diverse and cleaner energy technologies that will promote both energy reliability and our low-carbon objectives.

6.49 Coal (UK produced or imported) and nuclear power have traditionally offered sources of electricity relatively secure from sudden changes in other international energy markets. The future of coal generation and new measures to encourage the development of carbon capture and storage are discussed below. The future of nuclear generation is discussed in chapter 4.

6.50 Diversity goes beyond a simple choice of fuels. It relates to how the fuel or energy is moved and used and to the range of sources for any particular type of fuel. Additional electricity interconnectors, like the existing one to France, would increase resilience. Projects are being developed for new direct current electricity interconnectors to Norway and the Netherlands and discussion is underway on a possible link to the Republic of Ireland. These are essentially market decisions, driven by the commercial assessments of electricity suppliers.

We will continue to keep the diversity of the electricity mix under review.

Gas supply flexibility...

6.51 Demand for gas in the UK is highly seasonal. We have a relatively low level of strategic gas storage compared with France, Germany and Italy. This is not of itself a problem, provided that the market can continue to deliver sufficient flexibility to meet demand, especially as UK gas output falls and with it the capability of UK gas fields to meet short-term periods of high demand. Alternative ways of providing supply flexibility such as new storage projects and flexible import contracts appear to be being delivered by the market. The diversity that these projects can bring to the market in term of flexibility of entry points and means of delivery will be welcome. The provision of timely new infrastructure will be important in backing up these commitments and, along with progress on EU liberalisation, provides confidence that access to flexibility can be maintained.

We will closely monitor and assess the adequacy of provision of sufficient supply flexibility to the UK gas market.

Availability of Networks...

- 6.52 Gas and electricity networks, and their uninterrupted operation, are essential to security of supply. In other utility sectors, there are provisions for the appointment of an administrator in the event that the operator of a network becomes insolvent. During the passage of the Enterprise Bill last summer, we undertook to consider further the case for special provisions for gas and electricity. **We now propose to undertake a public consultation on the need for an administration regime for gas and electricity networks, including the scope of the provision, its potential effectiveness, and other details.**

Monitoring the situation...

- 6.53 We have set out above our response to the security of supply risks we face. All are important but none appears to pose an immediate or unmanageable threat. There are many triggers within a liberalised market to incentivise energy reliability. And markets are likely to deliver energy reliability most cost-effectively. The experience of California, though, shows that it is important for governments to monitor reliability, including how their own actions may influence market behaviours.
- 6.54 **We will continue actively to monitor energy security through JESS and to make the conclusions of that group publicly available.** The group will continue to provide the market with assessments of supply and demand information and will periodically review the dependence of the networks on particular facilities. **We will use the information gathered by JESS as a guide to issues in**

the market or regulatory system or elsewhere (for example planning) that may be preventing an adequate market response.

- 6.55 **Where the issues fall outside OFGEM's remit, close joint work between the FCO and DTI will be put in hand to monitor wider issues of energy security.**

Handling the carbon consequences of coal-fired generation...

- 6.56 For most of the time since the industrial revolution, coal has been the main source of primary energy in the UK. Even now coal generation provides around a third of the UK's power output. But in a low-carbon economy the future for coal must lie in cleaner coal technologies - which can increase the efficiency of coal-fired power stations and thereby reduce the amount of carbon they produce - or carbon capture and storage. Electricity generation from coal will become more expensive when measures already agreed in the EU's large combustion plant directive (to control emissions of sulphur dioxide, nitrogen oxides and dust) comes into effect. Plant that does not meet demanding emissions standards is likely to be retired over the period to 2015. EU-wide carbon emissions trading will also make coal less attractive as a source of power. By 2020 coal generation's contribution to the UK's power output is likely to be significantly lower than today.

6.57 If ways could be found cost-effectively to handle the carbon, keeping coal-fired generation in the fuel mix would offer significant energy security and diversity benefits. Coal is easy to store and transport and can be sourced from diverse of stable suppliers both domestically and worldwide. Loads in coal-fired stations can also be varied relatively easily, so coal fired generation is particularly useful in meeting peak demand or covering for supply intermittencies in other fuels. This may encourage generators to keep some coal-fired plant so as to give themselves the capacity to meet demand under a variety of circumstances. But by itself this would be unlikely materially to increase UK energy security more generally.

6.58 If coal is to play more than a marginal role in the mix beyond around 2015, generators will need to find economic ways of dealing with the consequential carbon dioxide emissions. One option is to capture and then store the carbon dioxide. The most promising approach at present would be to lock the gas away in geological structures such as depleted oil and gas fields. There is significant international interest and effort going in to carbon dioxide capture and storage, especially in the USA and Canada, where many of the technical obstacles to economic implementation are being researched. The UK North Sea offers a potentially very valuable resource in this respect, as do other offshore reservoirs.

Carbon capture and storage may offer a promising way forward...

6.59 Carbon capture and storage (CCS) - and the potential value of carbon dioxide injection for enhanced oil recovery (EOR) as a means of extending the life of the North Sea oil reserves - is described in detail in the box below. The recent review of cleaner coal technologies²³, shows that CCS is currently constrained by a number of significant legal and technical issues. Measures to address these are the subject of a number of current follow-up projects.

23 Cleaner coal review: www.dti.gov.uk/energy/coal/cct

Carbon dioxide capture and storage (CCS)

CCS offers the potential to deal with the carbon emissions from using fossil fuels in electricity generation or from other large CO₂ sources (such as chemical plants and refineries). In coal plant it could be achieved either by capturing the CO₂ from flue gases or technically more easily by gasifying the coal prior to electricity generation (in an integrated gasification combined cycle - IGCC - plant).

Once it is captured the CO₂ needs to be placed in some form of long-term storage. The Chief Scientific Adviser's Energy Research Review Group identified CCS as an area in which increased research effort could yield major breakthroughs. In particular, it suggested that effort be concentrated on fundamental research into storage which was less well understood than capture. The theoretical storage capacity of suitable geological formations (depleted oil and gas fields and deep saline reservoirs) is massive, subject to cost and the environmental and public acceptability.

European capacity for storing CO₂ in geological formations could be around 200GtC, mostly under the North Sea and mainly in the Norwegian sector and the UKCS. About 95% of this potential is in deep saline aquifers and only about 5% in depleted oil and gas fields. The North Sea oil and gas well capacity in the UKCS is sufficient to absorb all UK CO₂ emissions at current levels for up to 15 years, potentially hundreds of years if saline aquifers are included. Theoretically there could be further capacity in unmineable coal seams but further investigation is required.

Geological formations are capable of containing gas. They have done for thousands of years. Geological sequestration should be capable of retaining CO₂ for a very long time, perhaps indefinitely. But accessing reservoirs would necessarily disturb them and leakage might occur, for example through geological faults, seismic activity, failure of pipelines or other engineering components and groundwater movement. The political and public acceptability of CCS is likely to depend at least in part on a convincing risk analysis and on the ability to detect slow leaks if they occur.

A pilot project in the Norwegian sector of the North Sea is the only example of offshore carbon dioxide injection currently in process. This takes CO₂ that is co-produced with the gas in the Sleipner West field and injects it into an aquifer. In North America a number of projects are injecting CO₂ into oilfields to help increase oil recovery (known as enhanced oil recovery or EOR). During this process most of the CO₂ used ultimately remains in the oilfield, so is effectively sequestered.

EOR would allow additional oil recovery from the UKCS - 200Mt (1.5 billion barrels) may be achievable over 20 years. This compares to current annual oil production of about 130Mt. But the current rates of field depletion mean that this opportunity only exists in the short term and CO₂ injection needs to start by 2006/8 if it is to have an impact on the largest fields before the existing infrastructure is dismantled.

Enhanced oil recovery...

6.60 Although enhanced oil recovery (EOR) has benefits both in terms of extending our existing oil reserves and reducing carbon emissions, studies by Future Energy Solutions and others²⁴ suggest that EOR is unlikely to be cost effective in a time scale that will fit the existing UKCS needs. A single carbon dioxide pipeline from a medium sized coal power station together with onshore compression and wellhead injection and handling facilities could cost around £1-1.5 billion. The additional oil recovered could justify this investment but would not cover the costs of capturing and storing the carbon dioxide at source.

6.61 Coal-fired power stations offer the most likely source of the volumes of carbon dioxide that are likely to be needed for EOR. Integrated gasification combined cycle power plants (IGCCs) gasify coal to produce power, hydrogen and carbon dioxide. These offer a particularly promising source of carbon dioxide. Two schemes at Onllwyn in Wales and at Hatfield near Doncaster are actively being developed at present and have applied for Section 36 planning consent to build power generation capacity. This plant would also be able to generate large quantities of hydrogen, potentially of interest in enabling the development of production scale hydrogen projects.

6.62 If EOR is to be of value to the UK it needs to start within 5 years. Large fields (Forties, Brent, Ninian, Fulmar) would offer the best prospects. In addition to the short-term

carbon savings an EOR scheme would offer, this would also deliver a basic infrastructure to enable the delivery of carbon dioxide for later CCS as and when the technological, legal and gas security issues are resolved. The infrastructure would be significantly easier to fund from the anticipated EOR revenue streams than if it were to be funded for CCS alone from expected carbon emissions trading benefits. And since the technologies need to be demonstrated and tested in an offshore environment before firm commitments could be made to a CCS scheme, an EOR project would also provide significant help to the research and analysis of the options. There is also considerable international interest, and potentially access to international funding, provided the UK can offer leadership to demonstrate some technically distinctive options.

6.63 Given the potentially significant strategic role that might be played by CCS in longer-term energy security, we believe there is a strong case to examine more closely what might be done to help stimulate the take-up of EOR in the North Sea. **We will therefore set up an urgent detailed implementation plan with the developers, generators and the oil companies to establish what needs to be done to get a demonstration project off the ground. This study will reach conclusions within six months to enable firm decisions to be taken on applications for funding from international sources as soon as possible thereafter.** This will follow on from the initial work already sponsored by the DTI²⁵.

²⁴ The papers from this work are being published on www.dti.gov.uk/energy/coal/cct/co2capture.shtml

²⁵ The papers from this work are being published on www.dti.gov.uk/energy/coal/cct/co2capture.shtml

There may be opportunities for cleaner coal technologies...

6.64 Coal will remain the dominant generating fuel in large parts of the developing world such as China and India for many years to come. UK industry is potentially well placed to promote cleaner coal technologies, technology transfer and capacity building into developing countries. In the longer run it should be possible for UK project developers to benefit from carbon credits through international trading under the Kyoto Protocol clean development mechanism. With this in mind, we have already put in place a programme of support for advanced traditional cleaner coal technologies²⁶ which is intended to bring forward demonstrator projects that may help to showcase the relevant technology more widely.

The current Cleaner Coal Technology Programme (worth £25m over 3 years) has two components:

Support for research and development into new cleaner coal technologies. These include:

- support for 40 R&D projects covering new technologies for coal gasification, higher boiler efficiencies, co-firing with biomass and computer simulation of cleaner coal-fired generation;
- a collaborative agreement with the British Coal Utilisation Research Association (BCURA) to provide support for joint projects designed to contribute to university R&D; and
- investigation into the feasibility of underground coal gasification and coal bed methane in the UK.

Facilitating the transfer UK cleaner coal technology to other countries and promoting the exports of UK expertise and products abroad.

Activities have included:

- support for outward missions to promote UK technology;

Coal mine methane is a legacy to be managed...

6.65 Disused coal mines continue to produce methane even after they are closed, although the amount of methane reduces over time. Methane is significantly more damaging to the environment in terms of its global warming potential than carbon dioxide. Where it can be captured this gas can be used to generate electricity and heat, thus contributing to the energy mix and reducing the greenhouse gas emissions from abandoned mines significantly. To help stimulate the industry we indicated in the 2002 budget that we would, subject to Commission approval, grant coal mine methane (CMM) plant an exemption from the climate change levy.

- a Memorandum of Understanding with China for collaborative R&D and the promotion of cleaner coal technology;
- the production of a range of publications and seminars, in collaboration with the International Energy Authority, to promote cleaner coal technology and help reduce the non-technical market barriers to their development;
- help with initiating and establishing a major R&D collaboration on advanced supercritical technology under the auspices of the European Commission's Framework Programme; and
- liaison with the US Department of Energy to determine areas for future collaboration under the US/UK Memorandum of Understanding on Energy R&D.

Other work outside the CCT programme includes the possibility of Government support for retrofitting a supercritical boiler to an existing power plant in the UK.

26 Details available at www.dti.gov.uk/energy/coal/cct

- 6.66 The longer-term decline of methane emissions mean that CMM electricity generation will not offer significant long-term help to the reliability/diversity of UK energy supplies. But in the short term CMM presents a material environmental problem.
- 6.67 Even with existing levels of support a number of potential CMM electricity generation projects will remain uneconomic. The carbon valuation in the EU Emissions Trading Scheme is likely to provide a significant incentive to CMM mitigation projects that would otherwise not justify themselves. The route by which CMM may be able to claim credits under the EU Emissions Trading Scheme is expected to be project (as opposed to direct activity) based. **We will work to negotiate such an entry route and in the meantime we will work on a framework for pilot projects within the UK emission trading scheme for which CMM projects may be eligible.** The timetable for pilot projects is currently under review.
- 6.68 Even this, however, is unlikely to be sufficient to stimulate the industry in the short term, given the costs of generation from CMM as compared with the market price for electricity. We will continue to work with the industry to explore ways, including through the licensing system, in which we can help recognise the environmental benefits it secures. The industry has argued for the introduction of an obligation equivalent to the renewables obligation. But the renewables obligation has a specific aim - to develop long term carbon free generation technologies to the point where they become economically viable in their own right, and offering the obligation more widely risks undermining our longer term renewables aims. To offer a

similar level of support (via a separate obligation or equivalent) to the whole chain from methane extraction to generation would be difficult to justify, since it is not clear how much methane would leak naturally and how much is extracted by the process of recovery. **We accept, however, the need to move to control CMM emissions and will work with the industry and relevant environmental agencies to find ways of doing so more effectively.**

The UK coal mining industry...

- 6.69 The level of coal-fired generation is not of itself a limiting factor on UK mines. Coal production in the UK will decrease over coming years predominantly as a result of the increasingly difficult geological and mining conditions in UK pits. Within 10 years most of our existing deep mines are likely to have exhausted their economic reserves.
- 6.70 Coal, like oil and increasingly gas, is an internationally traded commodity. Supplies are available from a wide variety of reliable sources. The relevant infrastructure notably in ports and the rail network is likely to be sufficient to meet expected demand in a very wide range of scenarios, subject to market-led investment. Given this relatively mature and flexible market, there do not appear to be strong economic grounds for supporting UK coal production as a hedge against import prices or security of electricity supply grounds for supporting production as a means of increasing diversity.
- 6.71 We recognise that coal producers can make positive contributions to areas that are often economically and socially disadvantaged, by providing well-paid and skilled jobs. The UK's

coal industry is the most efficient in Europe. It has made great strides in improving productivity and has shown itself able, except in unfavourable market conditions, to compete successfully both with other fuels and with imports.

6.72 Where there is the potential for coal companies to make worthwhile investments they have to date been prevented by EU rules from seeking government help in doing so. In 2002 we negotiated the flexibility we receive at an EU level to correct this anomaly²⁷ so that **we now propose to introduce an investment aid scheme to help existing pits develop new reserves**, where they are economically viable and help safeguard jobs.



²⁷ The new Council Resolution on State aid to the coal industry (EC No 1407/2002)

Chapter 7 Productivity, competitiveness and innovation

7.1 Raising the sustainable rate of economic growth and maintaining industrial and business competitiveness are central to our economic strategy. Energy has an important role to play as a key input - without reliable supplies the economy and our national infrastructure would not function. But we must also ensure that the price of energy allows us to maintain our competitiveness. Our recent white paper on *'Productivity and Enterprise'*¹ set out the benefits of liberalised markets. As in other markets, vigorous competition in energy stimulates innovation and ensures the efficient allocation of resources, improving service quality and driving down prices.

7.2 To boost productivity and competitiveness we need to:

- ensure efficient markets which deliver competitive prices for business and domestic consumers;
- promote resource productivity - this will benefit the economy and individual businesses as well as increasing energy security and reducing carbon dioxide emissions;
- pursue our energy policy objectives through market mechanisms which promote competition, flexibility and efficiency; and
- help business by setting a clear and consistent long-term policy framework.

7.3 To deliver these goals in the energy system we need to address what the Government has identified as the key drivers of productivity. These are:

- to strengthen the **competition** regime to encourage firms to innovate and minimise costs and to deliver better quality goods and services to customers;

- to promote **enterprise** to help new and established businesses to start up, develop and grow;
- to improve **skills** through better education for young people and greater training opportunities for those already in the workforce;
- to support **science, research and innovation** to utilise the potential of new technologies and to develop new ways of working; and
- to encourage **investment** to improve the stock of physical capital.

We need to maintain competitive energy prices...

- 7.4 The energy sector represents around 4% of UK GDP but is a required input to the other 96%. To maintain competitiveness and encourage inward investment, energy for businesses and consumers must be competitively priced, including in comparison with other EU and G8 countries.
- 7.5 Vigorous competition improves efficiency and drives down prices. This has already been seen in energy markets. For domestic consumers, average prices in real terms fell by 10% for gas and 19% for electricity between 1997 and 2002. For industrial users, between 1997 and 2001, electricity prices fell by 22% in real terms, even when the climate change levy is included. This can be attributed to measures like the introduction of NETA, increasing competition in the supply market and the reduction in the fossil fuel levy feeding through to contracts. Our industrial gas and electricity prices were the second and third lowest respectively in the EU in 2001. Our domestic gas and electricity prices were the second and fourth lowest.

¹ *Productivity and Enterprise: A World Class Competition Regime*: July 2001

7.6 The impact of the measures to promote energy efficiency proposed in this white paper should mean that, for many households and users, energy bills should fall as the amount of energy needed and consumed is reduced, although the unit price for energy charged to consumers and users is likely to rise. Over the 17 years to 2020, the policy measures suggested here - on emissions trading, renewables and energy efficiency - might add approximately: 5-15% (per unit) to household electricity prices and less than 5% to household gas prices; and 10-25% to industrial electricity prices and 15-30% to industrial gas prices². Such price increases would not translate into similar increases in energy costs. A part of the price impact reflects energy efficiency measures which should lead to reductions in energy use.

7.7 Assessments like these are very uncertain and it will be important to keep price impacts under review. Much of the impact is due to the EU emissions trading scheme (which, being EU-wide, will impact widely on European prices) and is dependent on how the scheme develops as well as on the price of carbon in the trading market. It is important to put these potential rises in context. Electricity prices have fallen significantly in real terms over the last 20 years to their current historically low level. Even under a high case scenario the price of electricity to domestic consumers should remain below that for, for example, the 20 years to 1995. For industrial consumers, prices might return to the levels of the early 1990s but remain below those for the whole of the 1970s and 1980s. For domestic consumers, a high case scenario could see prices rising to late 1990s levels, although

this would still be below the level during nearly all the 1970s and 1980s. Industrial gas prices have already increased from a historically low level in the mid 1990s. The high case scenario is that they might return to the level of the late 1980s. To the extent that such an increase in gas prices reflects a rising wholesale price, this will also affect the UK's competitors in Western Europe in a fully liberalised gas market.

7.8 NETA was introduced in 2001 to replace the electricity Pool and was designed to bring greater efficiency to wholesale electricity trading while maintaining the operation of a secure and reliable electricity system. Under NETA the bulk of electricity is traded forward through bilateral contracts and power exchanges. It also includes a short term balancing mechanism to ensure supply meets demand at all times. NETA provides for more direct competition in wholesale electricity than occurred under the Pool. Traded wholesale electricity prices are around 40% lower than in 1998. The market has now seen a significant increase in liquidity and trades.

7.9 Our market is also - unlike California in 2000 - dynamic. Under NETA, generators and suppliers are encouraged to use hedging arrangements and contracts to avoid exposure to volatile prices in the balancing mechanism. In California, regulators prevented suppliers buying power on long-term contracts. As a result, forward signals were too weak to trigger new generating plant. California also faced the reluctance on the part of regulators to adjust price controls on consumer prices (price controls in GB were abolished in 2002), transmission

² All price assumptions in real terms.

constraints, and very fast demand growth. The UK market is different. Nonetheless we recognise we must remain vigilant.

7.10 The UK market is also increasingly competitive. The number of companies generating electricity has risen considerably from 6 at the time of privatisation to over 30 by October 2002. Competition is also forcing companies to work harder to attract and retain customers. By June 2002, 8.3m domestic electricity customers - 34% of total domestic customers - had switched from their incumbent electricity supplier. So had 7.1m domestic gas consumers - 36% of the total. Although switching continues to take place at a high rate - 115,000 electricity customers change their supplier every week - the market is not yet mature. We are working with OFGEM, Energywatch and the industry to ensure that the market works better and that consumers have confidence in it. In particular we are supporting efforts to stamp out mis-selling of electricity contracts, improve the customer transfer process and ensure that mistaken transfers are corrected quickly.

7.11 Energywatch will also be seeking to ensure that both the industry as a whole and individual companies improve their performance in a range of other areas of customer contact, including the administration of complaints and the management of accounts. This is designed to reduce complaints by addressing them at source. We will also consider, with Energywatch, OFGEM and the industry, whether the funding arrangements that support Energywatch can more accurately reflect the performance of suppliers in relation to their customers.

Energywatch

Energywatch was established under the Utilities Act 2000 as an independent advocate for consumers in the gas and electricity markets. It works closely with OFGEM, the gas and electricity regulator, which carries enforcement powers. Energywatch's aim is to provide consumers with a 'one stop shop' service that:

- investigates and resolves consumer complaints about energy companies;
- helps the energy companies improve their complaint and enquiry handling;
- deals with enquiries from members of the public; and
- produces consumer information and advice.

Energywatch recently published its Forward Work Programme for 2003/4 outlining its key priorities. The document is available on Energywatch's website:

(www.energywatch.org.uk/about_energywatch/forward_work_plan/index.asp)

...there is a clearly defined role for Government...

7.12 The role for Government in the market is to set the right competition and regulatory framework. We recognise that competitive markets cannot deliver some wider policy objectives. We have a role in correcting market failures, including countering socially or environmentally undesirable outcomes. For example the market may not properly value externalities created by energy efficiency or innovation. But government intervention is justified only where it is well targeted, cost-effective, affordable and efficient, promoting appropriate signals within a credible long-term framework.

- 7.13 As stated in chapter 1, this white paper demonstrates our commitment to the principles of better regulation. In particular:
- to engage with stakeholders to find out what they need from policy;
 - to examine what instruments are available to achieve those outcomes, with a preference for market measures;
 - to treat regulation as the last option if nothing else will work;
 - to use existing regulations where possible; and
 - to impose new regulation, exceptionally and then only when it is fit for purpose.

We must seize opportunities to promote enterprise...

- 7.14 Moving to a low carbon economy also presents opportunities for businesses to seize competitive advantage. We have established a number of Innovation and Growth Teams (IGT) and some of these have looked specifically at energy issues. For example the Automotive IGT considered the future contribution of low carbon transport within its overall remit of safeguarding the competitiveness of the UK's automotive sector. Manufacturing standards - be they quality, environmental, health, safety or security - also have a vital role to play.
- 7.15 Businesses will need to adjust their own operating practices to reduce their carbon intensity and will need advice and incentives to help them. This means simplifying access to funding, particularly for smaller businesses, alongside DTI's reform of its general business support schemes, replacing

them by fewer, streamlined schemes. All this will help businesses to seek funds for the purposes of energy innovation. Local Energy Efficiency Advice Centres will also be able to advise on national sources of funding.

We will complement this by developing a single web-based portal for businesses wanting access to energy support schemes, as part of a single knowledge bank for business support schemes. The Energy Saving Trust and the Carbon Trust are also piloting a project for Small and Medium-sized Enterprise Energy Advice Centres (SMEEACs).

- 7.16 The PIU called for a fundamental review of low carbon support programmes aimed at business, particularly the Carbon Trust and the Energy Saving Trust. Although we consider that some of these bodies and programmes are too new to review now, **we will review low carbon delivery programmes and associated support bodies before the end of 2004 in the context of a review of low carbon instruments more generally in advance of the introduction of the EU emissions trading scheme.**



Resource Productivity and Sustainable Consumption and Production (SCP)

The Strategy Unit's (formerly PIU) report, *Resource Productivity: making more with less* (November 2001) was one of three linked reports which also included its Energy Report and its recently published waste report, *Waste not, want not* (November 2002). The outcome of the World Summit for Sustainable Development last year, particularly a commitment to a ten-year drive on SCP, has recently re-focused our follow-up work on resource productivity. In coming months we will develop a strategic overview of resource productivity and SCP more widely. This will:

- set out the economic, social and environmental rationale for long-term policy planning to decouple economic growth from environmental degradation and resource use;
- draw on the two major policy blocks of energy and waste as core elements of an SCP future;
- consider the case for and identify further indicators for resource use as a means to stimulate and track long-term improvements;
- set out our approach to sustainable consumption, with specific proposals to help empower consumers and improve environmental impacts of goods and services (eg with better information right through the supply chain); and
- identify the key policy levers for encouraging SCP, and set out how a co-ordinated use of tools and instruments could drive such a programme - eg economic pricing instruments, support for innovation, procurement, signalling of future targets and minimum standards.

Addressing skills...

7.17 We need to address skills development, training and an ageing workforce in the energy industries. The problems are widespread:

- nearly a third of staff in offshore oil companies are over 45 and only 6% under 25. 20% of companies provided no regular staff training - nearly 40% for smaller companies³;
- even without new build the nuclear fuel cycle, power generation and environmental restoration sectors are likely to need around 19,000 graduates and skilled trades people over the next 15 years to replace retirements and satisfy demand in environmental restoration⁴;
- the Gas and Water Industry National Training Organisation (GWINTO) has predicted that there could be a major shortage of skilled gas installers in the coming years; and
- key skills in companies building major infrastructure such as power stations and refineries are currently concentrated in the over-50s.

7.18 Many employers invest in training but finding time and resources can be difficult, particularly for smaller companies. Our *Manufacturing Strategy*⁵ emphasised the importance of a skilled workforce to a productive and competitive economy - not only technical skills but also leadership and management

3 Skills Foresight, *The Industry Survey*, OPITO 1999

4 *The Report of the Nuclear Skills Group*, DTI, December 2002 (www.dti.gov.uk/energy/nuclear/skills/nsg.shtml). The figure of 19,000 is based upon the age profile that currently exists in the sector and the assumptions that the fuel cycle will remain stable, the planned closure programme of Magnox and AGR power stations will proceed and that the numbers engaged in environmental restoration will double over the next 15 years. No allowance has been made for potential new build.

5 *The Government's Manufacturing Strategy*, DTI, May 2002 (www.dti.gov.uk/manufacturing/strategy.htm)

skills. It also highlighted the need for a demand-led approach, combining government investment, access to best practice support and increased support for the science base. This implies close co-ordination across the industry, in particular between employers and education and training providers and also through supply chains (especially where seasonal shifts in workloads are a factor).

We are addressing similar skills needs across the economy...

- 7.19 Such problems are not energy-specific. We are already addressing common problems across the economy⁶ which are also relevant to the energy sector. In particular we are:
- investing an extra £100m per year by 2005/06 through the Office of Science and Technology (OST) to improve the development of the UK's science and technology skills base;
 - targeting science and mathematics teaching in schools to ensure that we have the right mix of teaching skills at primary and secondary level and also providing resources (including £60m between 2000 and 2002) to modernise and upgrade science laboratories;
 - commissioning an independent review into how business can draw more effectively on university expertise, to report in summer 2003;
 - publishing a new skills strategy for England in June 2003 aimed at reducing our productivity gap with major competitors.

It will cover both demand (from employers and their investment in skills and training) and the supply of skilled people.

Government, business, the new Sector Skills Councils (SSCs), the Sector Skills Development Agency, the Learning and Skills Council, Regional Development Agencies, other public and private bodies and employers will need to work together to identify skills needs and measures to deliver them. Resources for SSCs will increase to £42m in 2003/04, to £45m in 2004/05 and to £48m in 2005/06⁷;

- raising the profile and attractiveness of apprenticeships with a major marketing campaign to promote Modern Apprenticeships. A new National Modern Apprenticeship Task Force has been set up as a high level, employer-led body, driving the expansion and development of Modern Apprenticeships, so helping to meet the nation's skills needs and the aspirations of young people; and
- extending training for lower-skilled workers, helping highly skilled individuals to enter the UK and encouraging take up of Investors in People in small firms.

The energy sector also has specific needs...

- 7.20 We will ensure that these cross-cutting initiatives take proper account of energy issues, such as the move to a low carbon economy, which will affect businesses across the economy. For example:

⁶ Links to more detailed information about the measures set out in this paragraph and others can be found on the DFES and HM Treasury websites (www.dfes.gov.uk/learning&skills/index.shtml) (www.hm-treasury.gov.uk/Documents/Enterprise_and_Productivity/Research_and_Enterprise/ent_res_roberts.cfm)

⁷ www.ssda.org.uk

- our Fuel Poverty Advisory Group is considering ways to encourage small firms to take on apprentices and possible links to government and local authority funded programmes; and
- we are working closely with the industry and training providers to review the skills and research capabilities required to manage more distributed generation in the future. And we are looking into supporting the creation of a 'centre of excellence' in distributed generation which will bring together universities that have power systems expertise to enhance UK R&D capability.

7.21 We recognise the interrelationship between skills, research and innovation: skills tend to drive innovation; in turn innovation creates more demand for new and established skills. A healthy research base is crucial to nurturing the skills needed to manage the effective application of emerging new energy technologies. Not all research training in our universities will produce radical new technologies but the skills and expertise developed will equip people for the vital task of implementing and maintaining new energy infrastructure.

7.22 We are committed to working with employers in the energy sector, both through the evolving SSCs and the SSSA, involving Government and other bodies at central, devolved⁸, regional and local level as well as education and training providers. This includes the SSC for the oil and gas extraction and chemical manufacturing sector (COGENT⁹), which was set up in April 2002.

⁸ Training and education are devolved issues and both the Scottish Executive and the Welsh Assembly Government will have their own skills strategies and policy measures

⁹ www.cogent-ssc.com

COGENT

COGENT works with employers, Government and education and training providers. It aims to stimulate action at all levels of industry and emphasises that skills and training have to be a Board-level concern. It has already launched:

- an offshore technician training scheme to bring in 150 new trainees each year;
- a programme aimed at engineering undergraduates, promoting careers in the oil and gas sector; and
- interactive web-based material for schools, featuring young people talking about their jobs in the industry.

It also includes the developing SSCs for the Process and Manufacturing sector and the Science, Technology and Engineering Training Alliance (SEMTA), which will address some energy-related areas.

7.23 Upgrading skills will be vital for effective delivery of the step change in energy efficiency, particularly in the household sector, which is our goal. We therefore welcome the proposed creation of an Energy Utility SSC and look forward to working through such an SSC, provided it achieves licensed status, to develop new ways to enhance the skills and training of employees in the energy efficiency industries.

7.24 It would be premature for Government to attempt to prescribe in detail what action should be taken to address skills in the various sectors of the energy industry at a time when a network of employer-led SSCs is emerging. **Through the SSSA we are working closely with employers to ensure**

that, as soon as possible, all parts of the energy industry are included within the emerging SSC network which has recently received a substantial increase in Government funding (see paragraph 7.19).

This will enable energy employers to articulate their needs, influence training providers and improve productivity and service delivery - at the same time building on existing work in the energy industry (in many cases undertaken by the former National Training Organisations) and new ideas and proposals. For example:

- the Electricity Training Association is commissioning a Skills Foresight Project to identify the skills requirements of the renewables industry to 2010; and
- GWINTO has made proposals to address shortages of gas installers including a pilot project with EAGA to deliver around 400 qualified central heating installers.

7.25 In December 2002 we published the results of a nuclear and radiological skills study¹⁰. Although there is no immediate, general skills shortage, some shortages do exist, particularly in safety case production and radiological protection; there are problems associated with an ageing workforce; competition for engineering and science skills; and uncertainty about the future of nuclear power. In response, a task group is being formed across the sector to develop and implement a workforce development strategy.

We need to support action by others...

7.26 We aim to achieve a better and more appropriately skilled workforce to meet our energy objectives - which means adopting a common approach that connects supply and demand for skills development. This must be driven by employers, in collaboration with others - with education and training providers and with related and supply chain partners. Innovative thinking will be needed, for example to make the most of transferable skills. Offshore construction and engineering skills can be adapted to the development of offshore windfarms, and engineers leaving the armed forces can be retrained to work in a variety of energy sectors. Employers could encourage older workers to stay on to help meet skills shortages and to assist with succession planning or training. Such a collaborative approach will enable industries to build on the skills that already exist rather than pulling against each other.

We also need to become more innovative...

7.27 To achieve our objectives we need to exploit existing and develop new technologies. Industry will need to innovate to maximise the opportunities offered by a low carbon economy and by global markets in environmental goods and services.

7.28 Government needs to play a role in developing innovation, because the benefits, in terms of the environment and security of supply, do not always deliver short-term profits for the private sector. This is particularly true for low carbon technologies where innovation is needed to support major changes over a significant period of time. We should be wary

¹⁰ www.dti.gov.uk/energy/nuclear/skills/index.shtml

of picking technology winners, but we are ready to fund innovation where this can achieve the best results in terms of its policy objectives. We will also work to create a policy environment that encourages the private sector to bring the key technologies forward, and play a key role in the delivery of major new infrastructure. Of particular importance will be the move towards internalisation of the cost of carbon, through emissions trading (discussed in chapter 2). This should also help to incentivise low carbon innovation.

We are keeping innovation policy under review...

In November 2002 we began a broad review - including energy - that will by July 2003:

- assess the UK's relative innovation performance;
- identify strengths and weaknesses and where market or institutional problems inhibit innovation;
- identify how Government policies can help; and
- set out a new strategy, involving key stakeholders, to improve the UK's innovation performance.

We have also set up an independent review, led by Richard Lambert, on strengthening links between business and universities. The review team will consult widely with business, universities and national and regional administrations in the UK and overseas. The review will complement and contribute to the Innovation Review and will report to Ministers in late summer 2003.

We will invest more in energy innovation...

7.29 For the PIU Energy Review, a report on the Government's support for energy research, development and demonstration was prepared by the Government's Chief Scientific

Adviser and a group of experts. This Energy Research Review Group (ERRG) was asked to look particularly at whether the overall level of expenditure on research, development and demonstration was sufficient and whether it was being targeted at the right areas.

7.30 The group concluded that the UK's spending should be raised. We are increasing public spending on energy research, development and innovation. DTI spent around £40m supporting sustainable energy-related research and technological development in 2001/02. We have already put in place a substantial renewables support programme worth in total £250m between 2002/03 and 2005/06. We will also, as described in chapter 4, increase the funding by a further £60m in this period. This is additional to the extra funding announced in the 2002 Spending Review, which allocated an additional £38m for energy policy objectives in 2005/06 compared with 2002/03.

7.31 We set up the Carbon Trust in April 2001 to lead on low carbon technology and innovation. It is spending £75m over the next three years. Funding for energy-related technology has also been available via the DTI's Innovation and Business Support programmes and through various European programmes. The Research Councils will spend over £11m on energy-related research in 2002/03. They have been allocated an additional £28m under spending review 2002 for further research in support of a sustainable energy economy.

Prioritise and properly co-ordinate our resources...

7.32 We endorse the ERRG's research priorities:

- carbon dioxide sequestration;
- energy efficiency;
- hydrogen production and storage;
- nuclear (particularly waste);
- solar PV; and
- wave and tidal power.

All these have been identified as areas in which increased support for research and development is particularly likely to result in step-change breakthroughs which will contribute significantly to carbon reductions.

7.33 ERRG also recognised the need for further research into social, economic and environmental factors as well as the crucial role of cross-cutting research, for example, in advanced materials, super-conductors, nanotechnology and biotechnology. It noted the importance of targeting support at basic research, as this is the point at which the maximum number of options can be generated for development and commercial application. We agree that basic research is critical to sustaining innovation over the longer-term.

7.34 A new Energy Research Network is being developed by the Research Councils to establish interdisciplinary teams with expertise in the scientific, technological, social, economic and health impacts of energy, providing much needed co-ordination and cohesion. A new UK Energy Research Centre will act as the hub, providing a national

and possibly European focus to integrate and accelerate research in this priority area. It will play a key role in co-ordinating research, facilitating collaboration with industry and UK participation in international projects, as well as being a centre of excellence in its own right. The centre will also signal the importance the UK attaches to energy research, helping to attract high-calibre scientists and graduates to the sector.

Work with others internationally...

7.35 A number of countries are developing low-carbon technologies. We need to focus on areas where UK industries can deliver innovations before or better than others. But international collaboration is important where pooling resources can encourage innovation at lowest cost.

7.36 **We are promoting an international initiative to strengthen efforts to bring science, engineering and technology to bear on efforts to slow climate change, initially through the G8.** We will also continue to collaborate in IEA work in areas such as renewables, end use and fossil fuel technologies, fusion and the exchange of scientific and technical information on energy technology. In our relations with the United States we will build on the Memorandum of Understanding on energy R&D between the DTI and the US Department of Energy to develop a more strategic collaboration on energy technologies. We have recently published a report that shows that it should be technologically and economically feasible to achieve a virtually zero carbon energy

system in the long-term, if we use energy more efficiently and develop low carbon technologies¹¹.

The European Framework Programme

The European Framework Programme supports R&D projects across a range of science and technologies.

The new programme, beginning in 2003, gives more emphasis to renewables. We will continue to assist UK applications for its support. The DTI has also commissioned a study on how Germany, Spain and the Netherlands promote the programme and organise energy research, especially in relation to small and medium sized companies.

The ENERGIE programme supports R&D in the three broad categories of renewables, rational use of energy and fossil fuels. UK participants have received nearly €180m from this programme, around 20% of its budget.

The UK also participates in nuclear research under the EURATOM Programme, primarily on fusion research.

7.37 In the long term, nuclear fusion could provide power generation from an abundant fuel source with zero carbon emissions and without the problems associated with long-term highly radioactive waste. We are a long way from a commercial power plant, but the technical feasibility of fusion power generation could be demonstrated within 25 years given adequate resources, possibly leading to full-scale power generation within 30 years. The next step towards this is the construction of the International

Thermonuclear Experimental Reactor (ITER) and the International Fusion Materials Irradiation Facility (IFMIF). The US and China have both signalled their intention to join ITER, an ambitious international research project to harness the potential of fusion energy. The project will involve the UK, US, China, Russia, Japan, Canada and other European nations. We expect ITER to lead, by the middle of this century, to the commercially viable production of clean, safe and renewable energy without the emission of greenhouse gases. The UK has considerable expertise in fusion and a complementary national fusion programme will also be needed to maximise the benefit from this expertise.

There will be significant new opportunities for investment...

7.38 The UK has a world-leading manufacturing, service and research capability in the energy field and a world-class science base. The power generation, transmission and distribution equipment and service supply industry alone makes a very substantial contribution to the UK's economy by way of goods, services and jobs. In 2001 21% of all industrial investment was made by the energy industries, compared to 20% in 1980¹². There will be considerable opportunities for the UK energy industry to invest to meet the challenges of delivering the infrastructure, new technologies and solutions we will need in the future. With its long-standing knowledge and experience of the UK energy scene, the UK equipment and service supply industry has a central role

11 *Assessment of Technological Options to Address Climate Change, A Report for the Prime Minister's Strategy Unit*. December 2002 (www.strategy.gov.uk/whatsnew/whatsnew.shtml)

12 *UK Energy Sector Indicators*, DTI, December 2002 (www.dti.gov.uk/energy/index.shtml)

to play in helping us to achieve our objectives. The white paper sets a clear, consistent and settled framework against which business can plan to that end. We will continue to work with industry to help business move up the value chain and reap the commercial benefits this will bring, both in the UK and abroad through export opportunities.



Chapter 8 Energy and the vulnerable

Energy policy raises a range of social issues...

- 8.1 Most of us take for granted being able to turn the lights on and keep our homes warm. But for some people, basic energy needs account for a disproportionate amount of their income. We must ensure that as we address the security, environmental and competitiveness aspects of energy policy we also take account of social impacts, especially on the poorest.

We are making good progress in tackling fuel poverty...

- 8.2 Some households need to spend more than 10% of their income to heat their homes adequately and affordably - the 'fuel poor'¹. Fuel poverty is caused by a combination of factors, including the energy efficiency of the home, fuel costs and household income. So we need better energy efficiency, competitive energy prices and increased incomes. We are committed to eradicating fuel poverty and have a legal obligation under the Warm Homes and Energy Conservation Act 2000 in England and Wales and the Housing (Scotland) Act 2001 in Scotland to specify a target date by which, as far as reasonably practicable, this will be achieved. *The UK Fuel Poverty Strategy*², published in November 2001, sets out policies for ending fuel poverty in vulnerable households in England - older households, families with children and householders who are disabled or have a long-term illness - by 2010.

We reaffirm these commitments and policies.

- 1 Different definitions of fuel poverty apply in each country, though we are working to bring them closer into line. There are also two methods of assessing income - either to include or exclude Housing Benefit and Income Support for Mortgage Interest. The figures quoted include this income. The numbers in fuel poverty are greater if this income is excluded.
- 2 www.dti.gov.uk/energy/consumers/fuel_poverty/strategy.shtml

We aim that as far as reasonably practicable no household in Britain should be living in fuel poverty by 2016-18³.

- 8.3 Encouraging progress is being made. In 1996 there were 5½ million UK households in fuel poverty. Today there are around 3 million. Of these about 2 million are vulnerable households. The 2½ million overall reduction is due mainly to energy price reductions and increased benefits. On current forecasts we might expect economic growth to take about 1 million more households out of fuel poverty by 2010⁴. We will publish our first annual progress report on the UK Fuel Poverty Strategy shortly⁵. This will provide more detail on the progress being made and the programmes in place.
- 8.4 Eradicating fuel poverty sustainably, particularly for the most vulnerable households, requires action in the home - better insulation, more efficient heating systems and minimising draughts. Together with the Devolved Administrations we fund a number of grant schemes to support this - Warm Front in England, Warm Deal and the Central Heating Programme in Scotland, the New Home Energy Efficiency Scheme (HEES) in Wales, and Warm Homes in Northern Ireland⁶. These schemes provide help for people on income or disability benefit. The energy efficiency commitment (EEC) requires half the target energy savings to be achieved in this priority group.

3 In England and Scotland the target date is November 2016. Scotland has an interim target of achieving by 2006 a 30% reduction of people in fuel poverty as shown in the 2002 Scottish House Condition Survey. The Welsh Assembly Government has proposed in their consultation document a target date of 2018. There is no date yet for Northern Ireland.

4 assumes that incomes grow by 2.5% in real terms each year to 2010

5 www.dti.gov.uk/energy/consumers/fuel_poverty/strategy2.pdf

6 www.eaga.co.uk and www.txuwarmfront.co.uk/content/general/default.asp

Our recently published policy on sustainable communities⁷ has an important role to play. Our target of bringing all social housing up to a decent standard will also contribute.

- 8.5 Continuing these initiatives in their current form and at their current levels would remove up to another 1 million vulnerable households from fuel poverty by 2010, though some of these will already have been removed through economic growth.⁸

But we need to do more...

- 8.6 Evaluations of Warm Front in England and a progress report on the first year of the EEC will be completed this year. These will help us assess the impact of the schemes and their contribution to our Fuel Poverty Strategy. The Warm Front review also provides an opportunity for changes to the scheme, looking ahead and ensuring the best use of our resources in fulfilling the Strategy.
- 8.7 **We are also exploring new ways of tackling fuel poverty.** Five pilot Warm Zones were established in 2001 - in Stockton, Sandwell, Hull, the London Borough of Newham, and Northumberland - bringing together the deliverers of Warm Front, energy suppliers, local authorities, health officials and others to provide a co-ordinated approach in a local area⁹.

7 *Sustainable Communities: Building For The Future* www.communities.gov.uk - see chapter 3

8 As with the estimated impact of economic growth, there is considerable uncertainty about the full impact on the numbers in fuel poverty.

9 www.warmzones.co.uk. A summary report evaluating the first year performance of Warm Zones is at www.est.org.uk/est/documents/warm_zones_evaluation_1_summary.pdf

Tackling fuel poverty through partnership

The Dundee Community Energy Partnership brings together Dundee City Council, Transco, the Scottish Executive, and Scottish and Southern Energy, to identify areas of good practice and establish a working model. Partnership workers go door-to-door throughout the city to determine if there is fuel poverty, what measures are needed, and what the best use of funding programmes would be to help the household out of fuel poverty.

- 8.8 To advise on progress and suggest improvements in delivering the fuel poverty strategy, we established the Fuel Poverty Advisory Group in England. A similar group works with the Scottish Executive on progress in tackling fuel poverty in Scotland. We welcome the English Advisory Group's first annual report¹⁰ as a valuable contribution to the challenge of meeting our fuel poverty targets. **We will work with the Group as we consider how its recommendations will be taken forward. In particular we will continue to:**

- **report annually on progress against the fuel poverty targets;**
- **keep under review the resources needed to achieve our targets;**
- **find ways to achieve greater efficiency in delivery, through closer co-ordination between the various initiatives which deliver energy efficiency improvements to the fuel poor;**
- **work across Government to ensure that policies on benefits, health and housing help to alleviate fuel poverty; and**
- **address the need to overcome skills shortages - see Chapter 7.**

10 www.dti.gov.uk/energy/consumers/fuel_poverty/fuel_adv_grp/report1.pdf

There is a need to tackle rural issues...

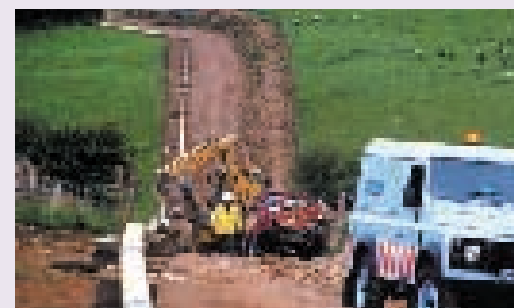
- 8.9 Most people in fuel poverty live in urban areas. But it can be more acute in the countryside, where houses tend to be older, less energy efficient and harder to heat. Also many people in rural areas do not have mains gas. Oil fuel, solid fuel, electric heating or liquefied petroleum gas (LPG) can be more expensive and less convenient. **The DTI is therefore working with Transco to identify areas where extensions of the gas network and connection to energy efficient gas central heating systems might be justified. We will explore options for pilot projects on gas extension.**
- 8.10 People living in rural areas are particularly dependent on cars and can be affected by higher fuel prices and the closure of filling stations. We have set up a taskforce with industry on services for rural motorists to look at issues such as the costs of environmental measures for small filling stations and schemes to support rural filling stations.

And internationally...

- 8.11 International development also has an important part to play in improving energy security in the medium to long term. We will promote economic growth, especially pro-poor growth, stability and good governance in energy-producing countries as part of our international development efforts. At WSSD¹¹ in Johannesburg last year it was agreed that concerted international action is needed for increasing access to sustainable energy

services as a necessary requirement for addressing international development and poverty reduction objectives. The recent DFID issues paper *Energy for the Poor*¹² explains the importance of access to affordable, safe and reliable energy services in the achievement of the international UN Millennium Development Goals.

- 8.12 **We shall strengthen international dialogue on energy and development. We will support and promote two international WSSD follow-up activities aimed at improving access to energy services - the Global Village Energy Partnership (GVEP), whose leading partners include the United Nations Development Programme (UNDP) and the World Bank, and the EU Energy Initiative for Poverty Eradication and Sustainable Development.**



11 World Summit on Sustainable Development - see chapter 4

12 www.dfid.gov.uk Issues and Briefing Notes

Section Four

Delivery through
partnership

Chapter 9

We need to work with others...

- 9.1 People gave us a very clear message in the public consultation leading up to this white paper. They told us that they care about the environment and that they want to play their part in tackling climate change. But they need practical leadership and help to understand what they can do.
- 9.2 We have set a lead in this white paper. We have set out new objectives for energy policy, including a clear commitment to move towards a low-carbon economy. And we have set out new measures to deliver our objectives.
- 9.3 We will need to work with others to achieve these goals. The products and services needed in future will depend on business enterprise and innovation. Local authorities and regional bodies are pivotal in delivering change in their communities. We will continue to work closely with the Devolved Administrations. We will continue to need a sound basis of academic research and information. Independent organisations and voluntary bodies can communicate messages to the public and help them to get involved in decision-making.
- 9.4 And Government itself must change so that energy policy is looked at as a whole. Our challenge is to achieve all our objectives together rather than pursuing them as separate streams. And this approach needs to be reflected in the way energy markets are regulated.

We need new ways of doing things in Government...

- 9.5 We have set out a challenging, long-term, agenda for change. We need to make sure we have the institutions in Government to deliver it.
- 9.6 We do not believe we need a new organisation for this. We want to concentrate our energies on following through the commitments we have made, not on creating new machinery. We have shown, during the preparation of this white paper, that with commitment and effective leadership we can achieve extremely effective interdepartmental working. We intend to build on this. The white paper itself will give us a new focus for our future efforts in this respect.
- 9.7 This work cuts across traditional departmental boundaries. To deliver the programme successfully, we need to provide a clear locus for:
- advising the Government on energy security (including longer-term international trends) and on carbon emission targets;
 - monitoring the introduction and impact of policies to deliver those security and carbon goals;
 - monitoring performance;
 - reporting to Ministers on performance and on any policy adjustments needed;
 - reporting publicly on performance; and
 - coordinating across Government on international sustainable energy issues.

- 9.8 **To this end, we will strengthen departmental analytical and strategic capabilities in the field of energy policy. The DTI's Energy Strategy Unit will provide the focal point of a network - a Sustainable Energy Policy Network - of departmental policy units that will be involved in delivering the white paper's commitments.** We expect the DTI, Defra, the FCO, the Treasury, the ODPM, DfT, the Scotland Office, the Wales Office, and the Devolved Administrations all to play a full part in this network. The regulators, particularly OFGEM and the Environment Agency, will also play an important part. The primary task of the network will be to ensure that the aims we have set out in this white paper are delivered. This will require the network, acting as a virtual unit, to ensure that the Government as a whole pursues effectively the policies and programmes that we need to deliver all our objectives, including a significant stepping-up of our international capability.
- 9.9 **To provide a clear line of accountability for the network, we will also put in place a new, ad hoc, Ministerial group which will oversee the delivery of the commitments in this white paper. This group will be chaired jointly by the Secretary of State for Trade and Industry and the Secretary of State for the Environment, Food and Rural Affairs. To support the Ministerial group, the governance of the Sustainable Energy Policy Network will be strengthened with the creation of a Sustainable Energy Policy Advisory Board, made up of senior, independent experts and stakeholders.** The role of the Advisory Board will be to provide the Ministerial group with a source of well-informed, independent advice on the approach and the work of the Network as a whole.
- 9.10 To ensure the transparency of the follow-up to this white paper, the Sustainable Energy Policy Network will publish annually a report on the progress being made towards the aims we have set out here. This will report on how the Government, regulators and industry are delivering security of short-term and long-term energy supply, moving towards our intermediate and longer-term carbon reduction goals (including those already set out in the Climate Change Programme), delivering our fuel poverty targets and maintaining the competitiveness of our energy markets more generally.
- 9.11 We will need appropriate indicators to monitor progress. Government already publishes an extensive range of energy indicators, and these will continue to be published annually.¹ But we need to focus on a smaller set of indicators to give a broad overview of whether overall energy policy objectives are being delivered. **Therefore, as a supplement to the white paper, we will be seeking views on the most appropriate indicators to focus upon.**
- 9.12 We also need to ensure that our future policies and measures take full account of their carbon impacts, that they are transparent and that information about them and about energy policy choices is available to business and the public in a format that they will find accessible. The recently updated guidance for regulatory impact assessments includes a provision to consider environmental impacts as part of delivering the Government's commitment to sustainable development. **A carbon impact assessment will in future be an integral part of assessing environmental impacts.**

¹ *UK Energy Sector Indicators*, DTI, December 2002
(www.dti.gov.uk/energy/index.shtml)

Linking to the work of OFGEM...

9.13 Government sets the regulatory environment in partnership with OFGEM, the independent economic regulator for the gas and electricity markets. OFGEM has a key influence on the energy markets for which it is responsible. The way in which OFGEM and Government discharge their responsibilities will play a central part in determining whether the environmental transformation and the security of the energy industry we envisage in this white paper are delivered in practice. OFGEM and the DTI share common statutory duties under the gas and electricity legislation, but have separate responsibilities: the roles are complementary. Our proposals will facilitate dialogue, and provide for a clear, shared, understanding of objectives.

9.14 To help minimise inconsistencies between our energy policy objectives and the regulatory regime for the gas and electricity markets we need to:

- raise the profile of environmental considerations in OFGEM's regulatory decision-making;
- improve co-ordination and understanding between Government and the regulator on environmental objectives; and
- strengthen OFGEM's transparency.

9.15 To this end we propose a wide-ranging programme of action:

- **OFGEM has committed to producing regulatory impact assessments, including environmental impact assessments, for all significant new policies. This will enhance transparency until there is opportunity to provide statutory backing for these**

assessments through primary legislation, bringing OFGEM into line with the position in other areas, notably the Financial Services Authority and Ofcom;

- **OFGEM is committed to publishing regular statements on security of supply;**
- **DTI, Defra and OFGEM will establish a joint working group on relevant environmental issues, and publish statements of progress through the Sustainable Energy Policy Network.** This group will build on the successful joint group which has been established for security of supply; and
- **we shall revise the statutory guidance on social and environmental issues in the light of this white paper making the guidance more specific.**

9.16 Many of the detailed rules for the electricity and gas markets are set in codes rather than in legislation or licence conditions. Industry code panels advise the regulator on proposals for modifications. OFGEM then makes decisions on code modifications. In making its decisions OFGEM is not bound by the panels' advice. We will:

- **seek to strengthen the code panels which advise on code revisions by ensuring they include people with expertise in renewables and the environment;**
- **work with OFGEM to strengthen the transparency and accountability of the code modification process.** OFGEM already publish reasons where they do not accept the advice of the industry code panel; and
- **also consult on a range of further measures, including whether it would be appropriate to provide for appeals against**

OFGEM decisions on certain code

modifications. This consultation will take place within the wider context of a House of Lords inquiry into the accountability of regulators.

- 9.17 It has been argued that we should introduce a power of direction over OFGEM. We believe that independent economic regulation delivers very significant benefits. Although a power of direction would allow the Government to have a direct impact on regulatory decisions, we consider it would undermine the independence of the regulator, and politicise the regulatory process so as to cause unacceptable levels of uncertainty in the markets.

We must also work closely with the Devolved Administrations...

- 9.18 **We will continue to work closely with the Devolved Administrations on energy policy objectives, in particular through the new Sustainable Energy Policy Network.** We are encouraged that the Devolved Administrations are developing strategies and targets on devolved aspects of energy policy.

Scotland and Wales - Approaches to Energy Strategy

In **Scotland**, the Scottish Executive is committed to raising the overall proportion of electricity generated from renewable sources to 18% by 2010 (including existing large hydro). The Executive has recently consulted on the potential to generate as much as 40% of Scotland's electricity from renewable sources by 2020. Scottish Ministers are currently considering the views expressed and intend to make an announcement shortly about a 2020 target and the measures required to achieve it.

The Scottish Executive is also strongly supportive of a single GB market in electricity through BETTA.

Wales has a climate, geography and industrial structure which present tremendous opportunities for clean generation technologies which can be developed very much in accord with sustainable development principles, including creating wealth for communities from energy generation and supply chain growth. Renewable energy, CHP and energy efficiency opportunities have already been examined in depth by the Welsh Assembly's economic development committee and are being supported within the EU Structural Funds programmes. Against this background the Welsh Assembly Government and relevant agencies are strongly pursuing an increasingly active clean energy/energy-conservation strategy which will be further boosted in the light of the developments described in this white paper.

Regional and local leaders...

- 9.19 Local authorities and other local bodies, regional chambers and Regional Development Agencies (RDAs) make decisions that are vital for energy policy - for example on planning, regeneration and development, procurement, housing, transport and sustainable development. Specific examples are set out throughout this white paper. In future there will be greater emphasis on local and regional approaches in delivering our energy objectives. Local authorities have a growing role as community leaders. Elected regional assemblies will provide additional political leadership².
- 9.20 We already work with local and regional bodies in England on energy issues - for example, on energy efficiency. **We will build on this to develop a new package of measures to promote national objectives through local and regional decision-making.** This will enable local and regional priorities to be better reflected in national policy. Over time a more proactive role will be developed for local and regional bodies in energy policy.³ Local policy is devolved and the Devolved Administrations will wish to consider whether to take action in their respective areas.
- 9.21 Several regions already have energy or renewables strategies. **We propose to build on these by taking steps to ensure that a strategic approach to energy is developed and implemented in each region. Ideally**

² In regions that choose to establish them.

³ The approach builds on policy set out in the recent white paper on regional governance *Your Region, Your Choice: Revitalising the English Regions*. Cm 5511 HMSO May 2002.

this strategic approach will be integrated as appropriate into existing strategies.

We expect that it will:

- **set out a strategic vision of the interaction between national energy policy and specific local and regional concerns;**
 - **include regional targets (such as for renewables and energy efficiency) negotiated between the region and national Government;**
 - **set out an action plan showing how regional bodies and local authorities intend to help to deliver objectives on energy through their various roles and functions; and**
 - **act as a contribution by the region to the development of national policy.**
- 9.22 We expect this strategic approach to be developed by a partnership of regional chambers, RDAs, Government Offices in the Regions (GOs), local authorities and other stakeholders, such as businesses, unions and voluntary groups. Its objectives will need to be delivered by all these bodies working closely together. In the longer term elected regional assemblies will take responsibility for leading the work where they are established. **We will consult shortly on detailed proposals.**

Arrangements in London

In London, the Greater London Authority (GLA) was created in 2000, with responsibility for preparing statutory strategies in a number of areas. We believe it is too early to change current institutional arrangements in London, given that the GLA has only been in existence for two years. But we welcome the Mayor's decision to prepare a non-statutory energy strategy.

9.23 RDAs' role as the drivers of regional economic development means that they can make a significant contribution to meeting the energy policy objectives set out in this white paper. In particular they will have a key role in implementing a strategic approach at regional level, and the Regional Economic Strategy will be a key driver in its development. **We will therefore strongly encourage RDAs to play a key role in the delivery of energy policy objectives at regional level. We will also support them in helping to develop their understanding of the implications of the white paper for their region and in identifying specific actions they can take to meet its aims.**

9.24 Many local authorities and regional bodies are already developing innovative initiatives and strategies that go beyond their statutory functions. In the longer term we want to see more taking such a pro-active role.

The Sustainable Energy Policy Network will have a remit further to develop the partnership with local and regional bodies on energy issues. In addition we will:

- **establish a new beacon councils theme on sustainable energy to promote innovative local approaches on generation and demand-side measures;**
- **promote energy efficiency and the roll-out of new technologies as areas in which local authorities can consider Local Public Service Agreements;**
- **urge local authorities to give energy issues priority at a strategic level, for example, through their Community Plans and Housing Strategies, consistent with the new strategic approach to be developed at regional level;**

- **encourage local authorities to take the lead, acting as catalysts for change, developing and facilitating cross-sectoral partnerships and providing advice and encouragement;**
- **review existing guidance to Energy Conservation Authorities on complying with the requirements of the Home Energy Conservation Act;**
- **consider with the Local Government Association (LGA) whether at the next review to include energy as a shared central-local priority; and**
- **consult on arrangements to collect and make available data on the pattern of energy usage in local areas, to enable local authorities and regional bodies to target activity more effectively.**

Examples of Successful Local and Regional Initiatives

The **Northern Energy Initiative**, an independent organisation undertaking work for the regional GO, the RDA, academic institutions and business, has developed an energy strategy for the North East of England. This sets regional targets for business energy efficiency, job creation in the energy sector, renewables and CHP. It has set up support for smaller businesses, a renewable energy agency and a 'clean coal' project.⁴

The South West RDA and GO have, with local Government and business, drawn up a **Strategic Framework for the Development of Renewable Energy** in the South West. The framework addresses issues such as skills and awareness, markets for renewable energy and planning. The partners have subsequently set up a not-for-profit company 'Regen SW' to guide the development of renewables in the region and to help deliver action under the strategic frameworks⁵.

Calderdale Council has utilised funding from the local Primary Care Trust to insulate the homes of people over 60. In 2001, 711 householders had their homes improved under this scheme.

The Council is in partnership with Yorkshire Forward, the RDA in a scheme to increase the take-up of solar PV technology throughout West Yorkshire. A recent report by the Audit Commission into the work of the Calderdale Housing Energy Team said, "the work carried out by the Council on energy efficiency measures and advice is impressive".

Woking Borough Council is the only UK local authority to supply customers with electricity, heat and cooling on private wire district energy networks, using fuel cells, CHP and solar power. It also supplies energy services to homes and businesses, financed through a public/private joint venture energy services company, for which the Council gained a Queen's Award for Enterprise.⁶

Leicester City Council has a major energy efficiency housing programme which incorporates expanding the district heating system, introducing CHP, renewable energy systems and energy efficient independent boilers, and a policy for installation of new, PVCu double-glazed windows to all council housing in Leicester.⁷

4 www.umitek.com

5 www.oursouthwest.com - "Regional Sustainability" page.

6 www.lgib.gov.uk/policy/Woking_intro.htm

7 www.leicester.gov.uk

Business can help...

9.25 Many of the measures set out elsewhere in this paper are designed to encourage action by business in general, as well as by companies in the energy generation, distribution and supply industries. Companies can also encourage action themselves - by reporting publicly on their own performance for instance, and by encouraging their customers and stakeholders to act themselves. For example:

- we have already called on businesses to report on their environmental performance, including greenhouse gas emissions, and have produced guidance to help them.⁸ We have put forward proposals in the Modernising Company Law white paper that would require leading companies to report on environmental issues where they are relevant to an understanding of the business. We have appointed an independent group of experts to provide guidance on how directors can assess whether an item is material and would have to be included in the annual report;⁹ and
- businesses can encourage their customers to be energy efficient. Energy suppliers for example are required to offer their customers incentives to encourage energy efficiency and should provide information about practical steps to reduce energy consumption. Retailers are working within the Energy Efficiency Partnership on how to promote more efficient products to consumers.

Developing a consistent and coherent message...

9.26 Our consultations featured a strong message that there should be wider and more sustained public debate about energy policy. We can facilitate that at both national and local level. This means consulting about key decisions and reaching key stakeholders on a regular basis. It also requires an effective and consistent joining up of the messages on energy across Government.

9.27 The new Sustainable Energy Policy Network will accordingly **bring together a cross-sectoral group of interests to agree on consistent and coherent messages on the vision set out in this white paper.** It will include the Small Business Service, the Energy Saving Trust, Energywatch, the Carbon Trust, the Low Carbon Vehicles Partnership, non-Governmental organisations and business groups, the Environment Agency and others.

⁸ The greenhouse gas emissions guidance and other reporting guidelines are available at www.defra.gov.uk/environment/envrp/index.htm

⁹ The Modernising Company Law white paper is available at www.dti.gov.uk/companiesbill/index.htm

Annexes

Annex A Glossary

Term	Definition
Balancing mechanism	The mechanism used by the National Grid Company to balance the supply and demand of electricity.
Biomass	Biomass is anything derived from plant or animal matter and includes agricultural, forestry wastes/residues and energy crops. It can be used for fuel directly by burning or extraction of combustible oils.
British Electricity Trading & Transmission Arrangements (BETTA)	Arrangements to create a single wholesale electricity market for Great Britain.
Capacity Margin Instruments (CMI)	A mechanism such as a capacity obligation that requires electricity industry participants to provide a defined level of generating capacity.
Carbon capture	Removal of CO ₂ from fossil fuels either before or after combustion. In the latter the CO ₂ is extracted from the fluegas.
Carbon credits	A credit or permit arising from a greenhouse gas emissions reduction scheme, such as emissions trading
Carbon emissions trading scheme/carbon trading	A scheme in which greenhouse gas emissions are controlled by setting a cap on total emissions and allowing the market sector(s) to reach an economically balanced response via trading of emissions allowances. Allowances are allocated initially, perhaps through a free distribution or through an auction, and the total allocation is adjusted (capped) periodically.
Carbon storage	The long-term storage of carbon or CO ₂ in the forests, soils, ocean, or underground in depleted oil and gas reservoirs, coal seams, and saline aquifers. Also referred to as engineered carbon sequestration. Carbon Capture and Storage can be referred to as CCS.
Carbon Trust	An independent not for profit company set up by the Government with support from business to encourage and promote the development of low carbon technologies. Key to this aim is its support for UK businesses in reducing carbon emissions through funding, supporting technological innovation and by encouraging more efficient working practices.

Term	Definition
CCGT	Combined cycle gas turbine - a gas fired electricity generation plant.
Climate Change Agreement	An agreement between the Government and a business user, whereby a reduced rate of Climate Change Levy is payable in return for a commitment by the user to achieve certain pre-determined targets for energy usage or carbon emissions.
Climate Change Levy (CCL)	A levy applied to the energy use of all non-domestic sectors. Subject to certain exemptions and reductions to encourage energy efficiency.
Climate Change Programme	Published in 2000, sets out the Government and Devolved Administration strategic approach to tackling Climate Change and meeting the UK's Kyoto target of a 12.5% reduction in greenhouse gas emissions from 1990 levels by 2008-2012 and the domestic goal of reducing CO ₂ emissions by 20% by 2010.
CMM plant	Coal Mine Methane plants generate electricity and heat from methane that is emitted from disused coal mines.
CO ₂	Carbon dioxide (a greenhouse gas).
COGENT	Sector Skills Council for the oil and gas extraction and chemical manufacturing sector.
Combined Heat and Power (CHP)	CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process, thereby discarding less wasted heat.
Community Energy Programme	A £50m, 2 year capital grants programme (2002-04) offering funding, information and support to Local Authorities, Registered Social Landlords, Universities, Hospitals and other public service organisations for the refurbishment of existing and installation of new community heating schemes. Operates across UK and is jointly managed by the Energy Saving Trust and the Carbon Trust on behalf of Defra.

Term	Definition
'Decent standards'	Set by ODPM, the decent home standard is a minimum standard that all social housing in England should achieve by 2010. A decent home is one that is wind and weather tight, warm and has modern facilities. Similar standards apply in the DAs.
Defra	Department for Environment, Food and Rural Affairs.
DETR	Former Department of the Environment, Transport and the Regions.
DFES	Department for Education and Skills.
DFID	Department for International Development.
DfT	Department for Transport.
Distributed generation	Electricity generation usually on a relatively small scale that is connected to the distribution networks rather than directly to the national transmission systems.
Distribution Network Operators (DNOs)	Companies that are responsible for operating the networks that connect electricity consumers to the national transmission system and provide interconnection with embedded generation.
EAGA	The Eaga Partnership manages fuel poverty programmes on behalf of the Government and Devolved Administrations.
Embedded generation	See distributed generation.
ENERGIE Programme	An EU programme supporting research, development and demonstration aimed at delivering cost effective solutions to key energy related problems on a European scale. In particular the aims are to minimise the environmental impact of the production and use of energy and to increase the share of new and renewable energy sources in EU's energy balance. See www.dti.gov.uk/ent/energie/index.htm
Energy Charter Treaty (ECT)	A multilateral treaty to promote trade, investment and transit of energy products between Contracting Parties and sets a standard for non-discriminatory access to energy supplies.

Term	Definition
Energy Efficiency Advice Centres	Network of centres across the UK providing free, impartial and locally relevant energy efficiency advice to householders and small businesses. Call free on 0800 512012.
Energy Efficiency Commitment (EEC)	The Energy Efficiency Commitment (formerly known as Energy Efficiency Standards of Performance, EESoP) is an obligation placed on all domestic energy suppliers to achieve a specified energy saving target through the installation of energy efficiency measures in homes across Great Britain. At least 50% of the benefits are focused on disadvantaged households. A similar scheme (Energy Efficiency Levy) operates in Northern Ireland.
Energy for the Poor Initiative	An EU initiative focusing on poverty eradication in developing countries by improving people's access to adequate, affordable and sustainable energy services.
Energy intensity	Energy consumed per unit contribution to Gross Domestic Product, ie for business sectors it is the energy per unit Gross Value Added. The equivalent for the domestic sector is energy consumed per household.
Energy Research Network	A new network being developed by the Research Councils to establish interdisciplinary teams addressing all aspect of energy research (scientific, technological, social, economic and health impacts).
Energy Research Review Group (ERRG)	A group of experts set up under the chairmanship of the Government's Chief Scientific Adviser. The Group was assembled to review Government support for energy research, development and demonstration as an input to the PIU's Energy Review. The report of the Group was published on 14 February 2002.
Energy Saving Trust (EST)	The Energy Saving Trust is an independent not-for-profit organisation, set up and largely funded by the Government to manage a number of programmes to improve energy efficiency, particularly in the domestic sector.
Engineering & Physical Sciences Research Council (EPSRC)	The UK Government's leading funding agency for research and training in engineering and the physical sciences.

Term	Definition
Enhanced Oil Recovery (EOR)	Increased production of oil from an oil field, brought about by injecting gas (eg CO ₂) or water to raise the oil pressure and force more oil out.
Environment Attache Network	Network of Environment Attachés at British Missions Overseas.
EU 6th Framework Programme for R&D	The European Framework programme supports R&D projects across a range of science and technologies. The 6th Framework Programme will start during 2003 with a large emphasis on renewables.
EU Data Transparency Initiative	This was announced by the Prime Minister at WSSD to increase the transparency over payments by companies to Governments and Government-linked entities, as well as transparency over revenues by these host country Governments.
EURATOM Programme	European Atomic Energy Community.
EUREKA programme	Established in 1985 by 17 countries and the European Union to encourage a bottom-up approach to technological development and to strengthen the competitive position of European companies on the world market.
European Emissions Trading Scheme	The EU emissions trading scheme, to be introduced in April 2005. See the section on 'Carbon emissions trading scheme', above.
Extractive Industries Transparency Initiative	The Extractive Industries Transparency Initiative was announced by the Prime Minister at WSSD, Johannesburg in September 2002. Its aim is to increase transparency over payments by companies to Governments and Government-linked entities, as well as transparency over revenues by host country Governments.
FCO	Foreign and Commonwealth Office.
FGD	Fuel gas desulphurisation.
Freight Facility grants	Government grants that are given to assist taking freight movements from road to rail or ship.

Term	Definition
Fuel cells	Fuel cells produce electricity from hydrogen and air, with water as the only emission. Potential applications include stationary power generation, transport (replacing the internal combustion engine) and portable power (replacing batteries in mobile phones).
Fuel poverty	The common definition of a fuel poor household is one needing to spend in excess of 10% of household income to achieve a satisfactory heating regime (21°C in the living room and 18°C in the other occupied rooms).
GLA	Greater London Authority.
Global Village Energy Partnership (GVEP)	Launched at the WSSD, this is a 10 year programme to reduce poverty and enhance sustainable development through the accelerated provision of modern energy services to those un-served or under-served.
Government Offices (GOs)	There is one Government Office in each of the 9 English regions. Their role is to act as the Government's eyes and ears in the regions, communicating the Government's messages and ensuring a regional input to the policy making process at the centre.
Greenhouse gases	Gases which contribute to global warming.
Grid Codes	The industry codes that govern the technical interface between the users of the electricity transmission systems and the transmission licence holders. Under a GB market the codes will be amalgamated into a single code.
Hybrid vehicles	Vehicles which use batteries or fuel cells as part of their power source in combination with a traditional internal combustion engine (ICE). Allows the ICE to be used with less energy loss and has overall greater efficiency.
Hydrogeneration	Electricity generation involving the use of water to turn a turbine.
Hypothecated revenue	Tax revenue that is raised for a specific expenditure purpose.
IAG	Interdepartmental analysts group.

Term	Definition
IFI	International Financial Institutions.
IMO	International Maritime Organisation.
Integrated Gasification Combined Cycle (IGCC)	IGCC plants initially gasify the raw fuel input, before passing the so-called synthesis gas through a conventional combined cycle set up. IGCCs can be designed to use a range of raw fuel inputs, including coal, oil products and wastes.
International Energy Agency (IEA)	An autonomous body, established in 1974 within the framework of the OECD, to implement an international energy programme.
IPCC	Intergovernmental Panel on Climate Change.
Joint Energy Security of Supply (JESS)	The JESS Working Group, set up in July 2001, has brought together DTI and OFGEM to monitor the security of energy supplies as part of an initiative to keep the reliability of energy supplies under ongoing review.
Kyoto Protocol	A Protocol to the UN Framework Convention on Climate Change (UNFCCC) agreed in 1997. Developed nations are required to cut overall greenhouse gas emissions by an average of 5.2 per cent below 1990 levels over the period 2008-2012.
Learning & Skills Council (LSC)	The Learning and Skills Council is responsible for funding and planning education and training for over 16-year-olds in England.
LGA	Local Government Association.
Liabilities	The costs involved in: decommissioning; the processing, long term management, storage and final disposal of waste materials and spent fuel; and the environmental remediation of nuclear sites.
Liquefied Natural Gas (LNG)	When natural gas is cooled to a temperature of approximately -160°C at atmospheric pressure it condenses to a liquid called liquefied natural gas (LNG). Natural gas is composed primarily of methane (typically, at least 90%), but may also contain ethane, propane and heavier hydrocarbons.

Term	Definition
Liquefied Petroleum Gas (LPG)	Gas usually propane or butane, derived from oil and put under pressure so that it is in liquid form. Often used to power portable cooking stoves or heaters and to fuel some types of vehicle, eg some specially adapted road vehicles and forklift trucks.
Low Carbon Vehicle Partnership	An action and advisory group, set up early in 2003, to bring together all stakeholders in the UK's shift to clean low carbon vehicles and fuel.
Major Infrastructure Projects	Projects such as interconnectors, which typically involve a substantial investment over a number of years to construct and bring into operation.
MARKAL energy model	A model whose main characteristic is the processing of detailed bottom-up data in order to meet pre-determined energy demand at the lowest cost. Its emphasis is on analysis of the longer term potential for new technology uptake.
Micro-CHP	CHP (as above), but in very small scale, typically below 5kW electrical output, applications (eg in the residential and commercial sectors). It is likely to operate in place of a domestic central heating boiler.
MtC	Million tonnes of Carbon.
Mtoe	Million tonnes of oil equivalent.
Market Transformation Programme (MTP)	A Government programme that aims to bring forward products, systems and services which do less harm to the environment, using less energy, water and other resources. The MTP provides strategic support to a growing set of 'product' policies that aim to encourage resource efficiency through supply-chain measures such as reliable product information, raising minimum standards and encouraging best practice.
MW	Mega Watt - a measure of power, one million watts.
MWh	Mega Watt hour, one thousand kWh. A 1 MW power-generating unit running for 1 hour produces 1 MWh of electrical energy.

Term	Definition
NEPAD	The New Partnership for Africa's Development.
New Electricity Trading Arrangements (NETA)	New Electricity Trading Arrangements - in England and Wales these arrangements replaced 'the pool' from 27 March 2001. The arrangements are based on bi-lateral trading between generators, suppliers, traders and customers and are designed to be more efficient, and to provide greater choice for market participants.
New HEES (Wales)	A scheme for the provision of energy efficiency improvements, in Wales. The 'Basic' scheme offers a range of insulation and basic heating improvements. 'HEES +' offers gas or electric central heating and is available to households containing lone parents, sick or disabled persons and those over the age of 60 in receipt of Income Support, Housing Benefit, Council Tax Benefit and income based Job Seekers Allowance.
ODPM	Office of the Deputy Prime Minister.
OECD	Organisation for Economic Cooperation and Development.
OFGEM	Office of Gas and Electricity Markets.
OPEC	Organisation of Petroleum Exporting Countries.
Photovoltaics (PV)	The direct conversion of solar radiation into electricity by the interaction of light with the electrons in a semiconductor device or cell.
PIU	Performance and Innovation Unit (now the Strategy Unit).
PPG	A Planning Policy Guidance note for England. PPG22 covers renewable energy and the planning system. The guidance notes are in the process of being replaced by Public Planning Statements (PPS).
RCEP	Royal Commission on Environmental Pollution.
Regional chambers	In each English region outside London there is a voluntary multi-party body with members drawn from local government and the social, economic and environmental sectors in the region.

Term	Definition
Regional Development Agencies (RDA)	The agencies aim to co-ordinate regional economic development and regeneration, enable the English regions to improve their relative competitiveness and reduce the imbalances that exist within and between regions.
Regional Selective Assistance (RSA)	RSA is a discretionary grant which provides assistance towards projects with fixed capital expenditure over £500,000 and which will create or safeguard employment in assisted areas.
Registered Social Landlords (RSLs)	RSLs are non-profit making bodies run by voluntary committees who provide rented accommodation at an affordable cost. Some also provide homes for sale through special schemes to help people on lower incomes become homeowners.
Renewable energy	Renewable energy includes solar power, wind, wave and tide, and hydroelectricity. Solid renewable energy sources consist of energy crops, other biomass, wood, straw and waste, whereas gaseous renewables consist of landfill gas and sewage waste.
Renewable Energy and Energy Efficiency Partnership (REEEP)	An international partnership to promote the growth of renewable energy and energy efficiency systems, launched by the UK at the WSSD.
Renewables Obligation	The obligation placed on licensed electricity suppliers to deliver a specified amount of their electricity from eligible renewable sources.
Renewables Obligation Certificate (ROC)	Eligible renewable generators receive Renewable Obligation Certificates (ROCs) for each MWh of electricity generated. These certificates can then be sold to suppliers. In order to fulfil their obligation, suppliers can either present enough certificates to cover the required percentage of their output, or they can pay a 'buyout' price of £30 per MWh for any shortfall. All proceeds from buyout payments are recycled to suppliers in proportion to the number of ROCs they present.
Regional Economic Strategies (RES)	Produced by RDAs with partners and stakeholders in their region. These documents set out the framework of regional economic priorities which guide the activities of organisations promoting regional economic development, and are revised at least every three years.

Term	Definition
Science & Technology Attaché Network	Network of Science & Technology Attachés at British Missions Overseas.
Sector Skills Councils (SSCs)	SSCs are independent, UK wide organisations developed by groups of influential employers in industry or business sectors of economic or strategic significance, to tackle the skills and productivity needs of their sector throughout the UK.
Sector Skills Development Agency (SSDA)	The SSDA funds, supports and champions the new UK-wide network of influential employer-led SSCs to promote effective working between sectors.
Small and Medium-Sized Enterprise Energy Advice Centre	The Energy Savings Trust together with the Carbon Trust has launched a new service called Action Energy to give advice to Small and Medium-Sized Enterprises.
SMEs	Small and Medium-Sized Enterprises.
Sustainable Development Commission	The Commission's main role is to advocate sustainable development across all sectors in the UK, review progress towards it and build consensus on the actions needed if further progress is to be achieved.
UK Emissions Trading Scheme	A scheme which started in April 2002, under which 34 organisations have voluntarily taken on legally binding obligations to reduce their greenhouse gas emissions against 1998-2000 levels, delivering over 4 million tonnes of additional CO ₂ equivalent emission reductions in 2006.
UKCS	United Kingdom Continental Shelf - areas of seabed and subsoil over which UK exercises sovereign rights of exploration and exploitation of natural resources (popularly known as 'North Sea' but geographically wider than that).
UN Framework Convention on Climate Change (UNFCCC)	The international framework established in 1992 to tackle the issue of climate change and greenhouse gas emissions. The UNFCCC aims to prevent dangerous man-made climate change and commits developed countries to taking the lead in tackling climate change.

Term	Definition
UNDP	United Nations Development Programme.
USDOE	United States Department of Energy.
Warm Deal (Scotland)	A scheme for the provision of energy efficiency improvements, in Scotland, administered by Eaga Partnership for all housing stock and Local Authorities for their own stock.
Warm Front (England)	A scheme for the provision of energy efficiency improvements, in England, providing grants to households with children, who are on income related benefits. Larger grants are available for households whose occupants are 60 and over and receive an income related benefit.
Warm Homes (Northern Ireland)	A scheme for the provision of energy efficiency improvements, in Northern Ireland, designed to increase access to energy efficiency advice, including grant availability, among families with young children from low income families, particularly those from single parent families. It also aims to reduce the incidence of fuel debt within the target group, improve comfort levels and prevent cold related illnesses.
World Summit on Sustainable Development (WSSD)	An international summit, held in Johannesburg in August/September 2002, to reaffirm the international community's commitment to sustainable development.
WTO	World Trade Organisation.

Annex B References

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Defra	2002	Framework for Sustainable Development on the Government Estate	www.sustainable-development.gov.uk/sdig/improving/index.htm
Defra	2000	Warm homes and Energy Conservation Act	www.hmsso.gov.uk/acts/acts2000/20000031.htm
Defra	Ongoing	Market Transformation Programme	www.mtprog.com
DETR	2000	Transport 2010 - the Ten Year Plan	www.dft.gov.uk/trans2010/
DETR	1999	A better quality of life: a strategy for sustainable development for the UK.	www.sustainable-development.gov.uk/UK_strategy/index.htm
DETR	2000	Climate Change Programme	www.defra.gov.uk/environment/climatechange/cm4913/index.htm
DETR, Scottish Executive, National Assembly for Wales and the Department of the Environment in Northern Ireland	2000	The Air Quality strategy for England, Scotland, Wales and Northern Ireland Working Together for Clean Air	www.defra.gov.uk/environment/airquality/strategy/pdf/forward.pdf
DFID	2002	Energy for the Poor	www.dfid.gov.uk
DfT	2002	Airport capacity in the South East: Consultation Document	www.aviation.dft.gov.uk/consult/airconsult/se/mainconsult/15.htm

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DTI	2000	Conclusions in response to the public consultation - New and Renewable Energy: Prospects for the 21st century	www.dti.gov.uk/renew/condoc/policy.pdf
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IEA	2002	World Energy Outlook 2002	www.worldenergyoutlook.org/
IEA	2002	Renewables Information 2002	www.iea.org/stats/files/ren2002.pdf
Ilex	2002	Quantifying the system costs of additional renewables in 2020	www.dti.gov.uk/energy/developpep/080scar_report_v2_0.pdf

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National Grid Company	2002	NGC Seven Year Statement and Updates 2002	www.nationalgrid.com/uk/
NERA	2002	Security in Gas and Electricity Markets	www.dti.gov.uk/energy/whitepaper/index.shtml
NERA	2002	Electricity Markets and Capacity Obligations	www.dti.gov.uk/energy/whitepaper/index.shtml
ODPM	2002	Your Region, Your Choice: Revitalising the English Regions	www.regions.odpm.gov.uk/governance/whitepaper
ODPM	2002	Planning and Compulsory Purchase Bill	www.publications.parliament.uk/pa/cm200203/cmbills/012/2003012.htm
Office of Science and Technology	2001	Report of the Chief Scientific Adviser's Energy Research Review Group	www.ost.gov.uk/policy/issues/csa_errg/main_rep.pdf
OFGEM	2003	Initial thoughts on both the principles for developing the regulatory... when the next price control is implemented (open letter).	www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/1259_dnoletter_jan.pdf
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Royal Commission on Environmental Pollution	2000	22nd Report: Energy - The Changing Climate	www.rcep.org.uk/newenergy.html
Scottish Executive	2001	Housing (Scotland) Act	www.hmso.gov.uk/si/si2002/20022264.htm
Strategy Unit	2002	Waste Not, Want Not	www.piu.gov.uk/2002/waste/report/index.html
Trade and Industry Committee	2002	Security of Energy Supply	www.parliament.the-stationery-office.co.uk/pa/cm200102/cmselect/cmtrdind/364/36402.htm