

# 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 reliability<sup>1</sup>.
- 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 responding<sup>2</sup>. 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;**

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

<sup>2</sup> 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 electricity<sup>3</sup> 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.

<sup>3</sup> 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 report<sup>4</sup>, 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 industry<sup>5</sup> 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

<sup>4</sup> *Power system emergency post-event investigation* - [www.dti.gov.uk/energy/domestic\\_markets/security\\_of\\_supply/index.shtml](http://www.dti.gov.uk/energy/domestic_markets/security_of_supply/index.shtml)

<sup>5</sup> 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.<sup>6</sup> 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 years<sup>7</sup>, although new discoveries will be needed to renew reserves. Together with non-conventional<sup>8</sup> 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 total<sup>9</sup> 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 estimates<sup>10</sup> 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's<sup>11</sup> 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.<sup>12</sup> 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 reserves<sup>13</sup> 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 OPEC<sup>14</sup> 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%<sup>15</sup> 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.**

<sup>15</sup> *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

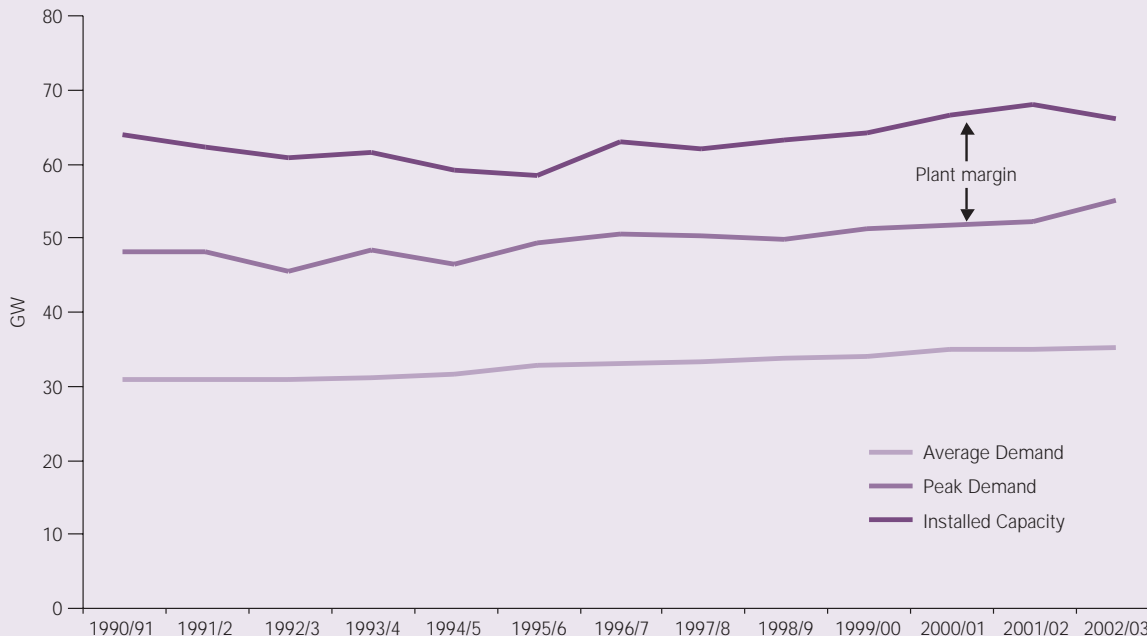
amongst major oil producing countries, along with all the other advantages of political stability, open and competitive markets, access to a skilled workforce and an extensive oil and gas infrastructure.

## 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 margin<sup>16</sup>.

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%<sup>17</sup> falling to around 20% in 2002/3<sup>18</sup>. 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

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

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

<sup>18</sup> 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 here<sup>19</sup>.
- 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 NGC<sup>20</sup> and electricity suppliers<sup>21</sup> 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 JESS<sup>22</sup> 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 technologies<sup>23</sup>, 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](http://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 CO<sub>2</sub> sources (such as chemical plants and refineries). In coal plant it could be achieved either by capturing the CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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 CO<sub>2</sub> into oilfields to help increase oil recovery (known as enhanced oil recovery or EOR). During this process most of the CO<sub>2</sub> 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 CO<sub>2</sub> 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 others<sup>24</sup> 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 DTI<sup>25</sup>.

<sup>24</sup> The papers from this work are being published on [www.dti.gov.uk/energy/coal/cct/co2capture.shtml](http://www.dti.gov.uk/energy/coal/cct/co2capture.shtml)

<sup>25</sup> The papers from this work are being published on [www.dti.gov.uk/energy/coal/cct/co2capture.shtml](http://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 technologies<sup>26</sup> 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](http://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 anomaly<sup>27</sup> 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.



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