

Future Proofing UK Energy



A Commentary on the Government's Energy Review Report
The Energy Challenge

REF
RENEWABLE ENERGY FOUNDATION



FUTURE PROOFING UK ENERGY

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Summary

Overview

In this response to the Energy Review report (*The Energy Challenge* – hereafter referred to as *TEC*) we argue that the Government has laid itself open to the charge of neither understanding nor adequately addressing the fundamental difficulties in energy supply that face the United Kingdom in the period from 2006 to 2020 and beyond. Unless this flawed approach is corrected in the additional White Paper (due in the first months of 2007), the UK will continue to be driven by market pressure and external circumstance towards a dangerous over-commitment to gas-fired electricity generation capacity that is at risk of failing to access economic or even sufficient fuel from 2010 to 2014, and perhaps earlier.

The proposed revisions to the Renewables Obligation are welcome but of limited significance. Renewables have much to offer, particularly on the smaller scale to individuals and communities, but regarded from strategic perspective even those renewables of industrial scale can only in the medium term constitute a modest contribution towards the United Kingdom's overall needs. To suggest otherwise helps no one, and may induce public and political complacency. The problem is particularly acute in the electricity generating sector. By the middle of the next decade a large generation gap, estimates vary between 20 and 30 GW, must be filled. Most of the existing nuclear plant will close before the first tranche of new fission capacity cautiously envisioned by *TEC* can be built. In fact it is unlikely that this can be financed without root and branch revision of the regulatory framework initially known as the New Electricity Trading Arrangements (NETA) and now in an expanded form as the British Electricity Trading and Transmission Arrangements (BETTA).

Indeed, it is improbable that anything other than gas can be financed under this framework, which had worth as a means of reforming an over-supplied market but is manifestly inadequate in the current situation of under-supply. Simply, BETTA gives little incentive for the serious investments now required to ensure reliable supplies to the United Kingdom and its people. This state of affairs cannot be allowed to persist, but *TEC* fails to recognise or engage with the situation.

The Renewable Energy Foundation has raised these matters in its previous publications, particularly in its *Manifesto 2005* and its submission to the Energy Review consultation process, and similar views are held by others in the sector. Indeed, it is now almost orthodox to believe that the *gas-plus-renewables* strategy advocated by the Government in the *Energy White Paper* of 2003 was dangerous and counterproductive in the effort to provide secure, economic, clean, affordable energy.

As the hesitant and indecisive content of *TEC* becomes better understood there will be growing disbelief that a review notionally undertaken to reduce risk to energy costs and physical supplies, and given sharp focus by events in the Ukraine in January 2006,

should have done so little, a gesture towards nuclear apart, to bring about actual change.

Conventional Energy and the Adoption of Renewables

The Foundation has engaged closely with those sections of *TEC* dealing with oil, coal, and gas and we recognise that this may seem paradoxical or to require special justification. In our view it is not often enough appreciated that **the prospects for renewable technologies are as critically dependent upon conventional energy as any other element of our society.**

In order to develop and apply renewable energy technologies, which are still in the early stages of adoption and development, the United Kingdom must be both economically stable and prosperous. Consequently, we are particularly concerned at what we regard as weaknesses in Government plans for the conventional sector. While rapid increases in fossil fuel prices or interruptions of supply may seem to create opportunities for renewable projects this is a superficial appearance only. The likelihood is that **economic stress caused by disruption in the conventional sector would weaken our society's capacity to adopt renewables in significant quantities and apply them with the sophistication necessary to make them viable in the longer term.** The present paper argues that **the alternative energy revolution, from fusion to renewables, will be built with wealth from coal, oil, and gas, or it will not be built at all.**

Can oil and gas supply keep pace with demand?

TEC rightly notes and expresses concern over the falling production of North Sea oil and gas. Given that the shortfall must be imported from reservoirs which are also of finite size, some of them geographically distant, there are grave doubts over the security of these supplies and the likelihood of affordable prices. *TEC* gives mixed-signal assurances that supplies are not in immediate danger but fails to present any convincing practical measures to reduce future risks. This is surprising and disappointing in equal measures.

The Government, as represented by its views in *TEC*, appears to be dangerously optimistic with regard to the realpolitik as well as the geology of hydrocarbon energy supply, and it is to be hoped that different views are held by those actually responsible for physical purchase. In common with many analysts we are concerned that there is a significant likelihood that the UK's electricity generation industry will not be adequately supplied with piped natural gas from Norway and the EU. Europe's growing need for fuel has outstripped investment in Russian upstream development and pipeline infrastructure, thus rendering this source doubtful in spite of its physical resources. The balance of supply

would therefore have to be sourced as Liquefied Natural Gas (LNG) from the Middle East. This assumption is not explicit in *TEC*, but can be found in other DTI documents.¹

Although large LNG import terminals are being built, we observe that the UK will be in global competition with other consumers, not least those in Europe, and that the rapidly developing global LNG infrastructure of gas fields, liquefaction trains, and ships is fragile and may well be under-supplied with gas long before 2020. In particular, we note that Qatar is developing alternative and more profitable options for exploiting its North Field, and we doubt that the Qataris will be attracted to expand their LNG exports beyond 70 million tonnes per year, a figure which could be reached as soon as 2012. If LNG exports are constrained by this and other factors the inevitable result will be price instability, an outcome that *TEC* acknowledges but, in our view, underestimates. If demand rises in line with the projections of the IEA it would be foolhardy not to plan for some upper limit to global gas production after 2020, a limit which is as likely to result from political considerations, including conservation and reserve extension measures, as geological facts.

We are concerned that *TEC* does not mention let alone discuss the possibility that at some point during the period leading to 2020, production of conventional oil may not keep pace with global demand. The tripling of oil prices during the last three years has been largely caused by continuous and extreme tightness of supply, resulting from strong demand, especially in China and India, but also by declining production in many parts of the world, for example in the UK itself, which at its peak in 1998 was the world's ninth largest producer, ahead of such OPEC members as Kuwait and the United Arab Emirates. *TEC* agrees with the IEA that global demand for oil will increase dramatically,² and we note with interest that the DTI is apparently well aware that non-OPEC production is likely to peak in the middle of the next decade.³

Some have suggested that incremental growth in output will be sustained both by OPEC and non-conventional hydrocarbons such as Canadian oil sands and Venezuelan bitumen. Both oil sands and bitumen processes are currently in production and will be of real significance in the future, but their contribution to growth in global production will be of necessity small relative to demand, a point also apparently understood by DTI but not made apparent in *TEC*. Furthermore, the refining processes are proving much more costly than originally anticipated and are also considerable sources of pollution.

So that the scale of the problem is clear we should recall that it is not eccentric to doubt whether OPEC will be able to increase production past 40–45 million b/d (today's OPEC production is roughly 30 million b/d) and maintain that output at a stable plateau for any length of time. Alongside this it should be noted that Canada's conventional crude oil

¹ For example in the chart 'EU imports of gas 2001-2030' available in the embedded spreadsheet in the presentation given to the third stakeholder seminar by Paul McIntyre under the title 'Security of Supply'. Downloadable from <http://www.dti.gov.uk/energy/review/seminars/page25171.html>.

² *TEC*, Chart 10, p. 79. Reproduced below, 'Global Energy Demand to 2030, by Fuel'.

³ See chart representing oil production 2004 to 2030, available in the embedded spreadsheet in the presentation given to the third stakeholder seminar as above.

production is declining, and it will be, perhaps, a decade before tar sands production reaches even 2 million b/d.

We find that the question of constrained oil supply is being discussed in the United States at the highest levels of the oil industry, and that there is lively discussion amongst politicians, Government servants, academics, and the general public. We also note that this subject is prominently debated in Europe and that its imminent possibility was mentioned by many of the public in their response to the Energy Review consultation document. 'Peak oil' is the subject of on-going discussions within the UK's Energy Institute and features prominently in the UK's premier petroleum journals, in particular *The Petroleum Review*. The critical question for the UK is whether oil can be supplied at a price that will not impair or disable the economy. Remarkably, *TEC* slips round this vigorous field of debate, an evasion which is difficult to excuse. If Government believes that concerns regarding resource erosion are exaggerated then it should explain why.

Coal, Gas, and CCS

In the light of the many other difficulties following from a neglect of the conventional sector, we urge the Government to reconsider its attitude to coal, which is inexplicably given scant attention in *TEC*. This is potentially disastrous, since without firmer leadership the market will take the path of least resistance towards an overdependence on gas. In fact, we suspect that the threat of power brownouts or outright cuts may cause the Government to bend the rules of the Large Combustion Plant Directive, and give extra life to the oldest and least efficient coal-fired power plants in Europe, resulting in an increase, not a decrease, of CO₂ emissions. This undesirable development should be forestalled by the adoption of modern coal generation with carbon capture and sequestration, a policy now beginning to enjoy wider support across industry.

The UK's fleet of coal-fired power stations is amongst the oldest and least efficient in Europe, and it is regrettable that the Government has not already developed a programme that would mandate their rapid modernisation and replacement by technologies that are already widely used elsewhere. We consider *TEC*'s proposals for further consultations to be weak, dilatory, and unlikely to lead to the resolute action which is required. In view of the sound advice offered to the Government by its own Clean Coal Task Group this is particularly disappointing.⁴

We note that there are proven technologies for the synthesis of liquid and gaseous fuels from coal, and believe that it is urgent that the UK follows China and embarks on a programme to manufacture transport fuel and energize electric power plants from the gasification of coal and low value carbon wastes. The CO₂ resulting from these processes should be used in the medium term as a working fluid for enhanced oil and gas recovery in the North Sea, giving decades of extra life to fields otherwise certain to decline. The

⁴ Clean Coal Task Group, 'A Framework for Clean Coal in Britain' (June 2006). Available from <http://www.tuc.org.uk/extras/coal.doc>, and <http://www.coalpro.co.uk/A%20Framework%20for%20Clean%20Coal.pdf>.

infrastructure thus financed by the incremental oil and gas can then be used for sequestration in deep undersea aquifers, as demonstrated by the Norwegians at Sleipner.

However, *TEC*, perhaps unwittingly, suggests that Government is ambivalent towards carbon capture and storage (CCS). Far from reinforcing apparent commitment the modest sums granted and the further research and development proposed in *TEC* are more likely to delay than accelerate practical application. All the technologies associated with CCS are currently commercial, contrary to the implication in *TEC*, and the legal problems raised are, arguably, trivial in comparison with the benefits of safely sequestering large quantities of CO₂ and recovering several billion incremental barrels of oil and gas. We would contrast the weakness of UK policy in this area with the more forceful and robust attitude taken by the Australian government.⁵

We share Governmental concerns that global development is resulting in a rising concentration of CO₂ in the atmosphere, and we accept that there are reasonable grounds for believing that this and other emissions of greenhouse gases may be affecting the global climate. However, as noted in other REF publications we believe that the policy outlined in the *Energy White Paper* of 2003 responded to these problems with a counter-productive misprioritisation of goals. It does not appear to us that *TEC* adequately addresses the failings of *EWP* 2003, and we are concerned that the policy implementation resulting from it will be as ineffective.

Specifically, it is a matter of raw practicality to recognise that climate change goals cannot be attained without a prior emphasis on security of supply and economic viability. Many prime-ministerial and ministerial statements suggest that Government now accepts that the UK cannot, *on its own*, do anything to affect the high and worrying concentration of CO₂ in the atmosphere or mitigate its effects. Implicit in these statements is the acknowledgment that **the United Kingdom may aspire to provide a compelling economic example to encourage joint action, but cannot rationally hope to do more**. It is therefore a striking paradox that while the Government accepts the UK's continued dependence upon fossil fuels, it offers only token solutions to the real, long-term problems facing us in relation to the security of supply and clean deployment of these resources. This does not seem likely to command international respect.

The EU Emissions Trading Scheme

In connection with this we regard the Government's faith in trading mechanisms to reduce CO₂ emissions as misplaced. We note that CO₂ emissions are rising throughout the EU and that the measures that caused these to fall during the 1990s, such as the reunification of Germany and the dash for gas in the UK, are unrepeatable. If industries and

⁵ See Australian Government, *Overview CCS Activities In Australia*. (CSLF Joint Policy & Technical Group Meeting, New Delhi, India 3-5 April 2006. Downloadable from: http://www.cslforum.org/documents/Australia_CCS_Activities.pdf#search=%22australia%20ccs%22

individuals are to be incentivized to adopt clean technology, we propose that carbon be taxed, a position held by many analysts and institutions. It is a long-standing and much discussed paradox that the Climate Change Levy is applied to Britain's output of electricity from nuclear power stations. Similarly baffling is the fact that Government policies on electricity trading rendered the UK nuclear industry unprofitable during the short period of peak UK-North Sea production when, due to the same market incentives, gas was being sold at low prices. These chaotic policy outcomes will not command international respect.

The Renewables Obligation

We are concerned, and have often argued, that the Renewables Obligation (RO) will not result in an uptake of renewable technologies that is optimal either for the UK or the long term interests of the sector. *TEC* recognises that the RO is unsatisfactory and proposes to remedy the situation with revisions offering differential levels of support to various technologies. While we welcome the open discussion of banding, which is a real step forward and to be applauded, it is regrettable that the bands are only intended to address the over-reward of near-market technologies and do not explicitly take into account the intrinsically superior merits of those renewable technologies which can supply firm capacity. The need for firm generating capacity in the next decade is acute,⁶ and in this light the RO's failure to specify reliable renewables for favourable treatment must be regarded as a continued defect.

Furthermore, we believe that the proposed delay in the banding of the Obligation, which will start in 2009/10, is unjustified. Indeed, we recommend that the process is accelerated to remove market uncertainty, which is already causing deferral of co-firing decisions and will further hold back the development of badly needed higher value renewable energy resources, such as biomass, tidal, and offshore wind. **In sum, delay in revision will temporarily compound the imbalance currently resulting in an over-build (and over-reward) of onshore wind.** This is extremely undesirable.

We believe that the Government may have been misled into conflating the short term interests of developers with the long term health and viability of the renewable sector in itself. Governmental intervention in markets is fraught with problems, and has, by and large, a dispiriting history. **We urge the Government to consider the possibility that the use of hothouse techniques to force growth in renewables may:**

- 1 Increase system costs and distract attention from the conventional sector with the net effect that the economy will be damaged in the medium and long term leading to inadequate technological research and development in alternative energies of all kinds.**
- 2 Stunt innovation in renewable technologies by offering premature and undeserved rewards.**

⁶ See section 3.5 below.

Conclusion and Recommendations

In our view the forthcoming White Paper requires radical re-thinking and must be designed to go beyond and supersede *TEC*. This revaluation must be grounded in realism and driven by aggressive innovation in all fields. The Renewable Energy Foundation is first and foremost concerned to support the development of the many renewable resources available to the UK, but this cannot be achieved economically within the regulatory framework that the Government has introduced. If there is, as we argue, a high risk of conventional energy supply constraints, then the energy price projections upon which *TEC* is founded are at best incomplete and at worst irrelevant. Should fossil supplies, particularly liquid and gaseous hydrocarbons, be constrained and prices high then renewable energy developers will be encouraged if not fully incentivised by market considerations alone. It should then be possible to consider replacing the intrusive pseudo-market of the Renewables Obligation with the simpler option of guaranteed feed-in prices. The moderate and readily fine-tuned risk exposure of such a system would reward carefully engineered projects, while discouraging slipshod speculation. In such circumstances the large-scale development of offshore wind in areas that the Government has designated in the Wash, Thames Estuary and North West England all close to load centres, would be correctly and rationally supported. As we have noted before, ways must be found to maximize the usefulness of offshore wind by means of electricity storage, a technology after all invented and first developed in the UK.

As argued above, this development must go hand in hand with the prudent use of conventional energy. Coal is the only fossil fuel that is widely dispersed throughout the world, and there are still significant mineable quantities in the UK, though some may require sophisticated techniques such as Underground Gasification or Coal Mine Methane, both technologies which are very well understood and increasingly attractive. We also note that the USA and Canada regard the development of methane from unmineable deep coal as a new energy resource and that if this is valued realistically, the production of such methane could be further enhanced by CO₂ injection for sequestration.

We conclude this summary by emphasising that in spite of the promises and the undoubted need for decisiveness *TEC* appears to continue the drift and delay that has characterized recent handling of investments in conventional energy. This exposes the United Kingdom to wholly unacceptable risk, and amongst the many disbenefits could significantly harm the long term prospects for renewables.

1 Introduction

On the 11th of July the Secretary of State for Trade and industry, the Rt Hon Alistair Darling, MP, presented the results of the Energy Review to the House of Commons in a document entitled *The Energy Challenge: Energy Review Report 2006* (hereafter *TEC*).⁷ This document and its related texts form the Government's report on the Energy Review commissioned by the Prime Minister in November 2005, and initiated with the publication of the consultation document, *Our Energy Challenge: Securing clean, affordable energy for the long-term* (hereafter *OEC*), in January 2006. The consultation period closed on the 14th of April after some 5,000 responses had been received.⁸ The Renewable Energy Foundation's submission to this review is summarised in Appendix 1 below.⁹

The Government's response to the consultation is complex, extensive, and to a great extent unresolved and pending much further consultation. It therefore requires careful analysis before it is possible to estimate the degree to which it has successfully addressed or promises to address the substantive issues raised by the consultees. With this document the Renewable Energy Foundation hopes to contribute to the process by performing a number of related functions:

- 1 Clarify status of the *TEC* text.
- 2 Provide a conveniently accessible text of all the Energy Review report's proposals, and offer a commentary upon them.
- 3 Reprint the Review's Implementation plan and offer a commentary upon it.

In the course of this we will:

- 1 Argue for a strong conventional sector to ensure a smooth and successful deployment of viable renewables.
- 2 Discuss the possible flaws in the price projections for the conventional sector.
- 3 Discuss the proposed and in principle welcome revisions to the Renewables Obligation.
- 4 Discuss the proposed revisions to the planning system.

The aim of our text is, in part, to provide the reader with a more informative resumé than that offered by the DTI's own Executive Summary, and at the same time to offer a series of comments which are intended to feed into debate leading up to the 2007 *Energy White Paper*.

A large part of the argument presented in this text ranges over *TEC*'s engagement with the provision of primary energy. As noted in the summary of the Foundation's

⁷ <http://www.dti.gov.uk/energy/review/index.html>

⁸ *TEC* describes this consultation process in Annex F (pp. 213-215), and the responses themselves are available at <http://www.dti.gov.uk/energy/review/consultation-submissions/page27883.html>.

⁹ The full text of our submission may be found on the DTI site above, and on our own site: <http://www.ref.org.uk>.

Energy Review consultation submission, we believe that the UK has no option but to rely upon fossil fuels for the majority of its primary energy for the foreseeable future. Even the most ardent proponent for renewable energy must recognise that it is only by maintaining high levels of societal wealth and technological sophistication that we can have realistic hopes of developing significant levels of non-conventional energy in the longer term. Put bluntly, **the future of renewable energy is as dependent on the conventional energy sector as any other part of our society.**

It is therefore of the first importance for the future of renewables that the conventional sector is successfully supported by Government in the short, medium, and longer term. We express concern in this critique that **climate change imperatives continue to drive the agenda in a way that distracts attention from the risks of constrained energy supply, and will in fact prove to be suboptimal with regard to climate change policy.**

We are particularly concerned that *TEC* **does not in fact make significant progress in reducing the likelihood of over-dependence on gas in the short and medium term.**¹⁰ Since anxiety concerning gas availability and consequent price was widely supposed to be one of the principal drivers of the Energy Review, views confirmed by events in the Ukraine in early 2006, this is extremely surprising.

In previous documents the Foundation has argued that the goals of the *Energy White Paper* of 2003 were not placed in optimal sequence, and we are disappointed that *TEC* fails to take the opportunity of providing leadership on this issue. While there is now widespread public recognition of the importance of climate change, the necessity of a sophisticated approach to the problem is less well understood. We will quote once again from an argument that we have offered in several forms since first presenting it in our 2005 manifesto. The text here is drawn from our Energy Review consultation response:

- If security of the primary sources cannot be guaranteed, then reliability at the point of use is questionable.
- If security and reliability of supply are compromised, then our economy will be damaged.
- If our energy supplies are insecure, unreliable, and unaffordable we will be unable to maintain and develop the high technological economy necessary to support our social aims and control the emissions of a large urban and industrial society.
- If the energy system in its total sense is unclean, as is seen in the CIS countries and parts of the developing world, then our social aims will be compromised by ill health in our population.
- And finally, if we cannot achieve any of the foregoing aims, our overall energy policy will be unsustainable, and the well-being of the United Kingdom and its people will be poorly served in the short, medium, and longer term.

¹⁰ For REF's earlier remarks on this matter see *Renewable Energy: The Need for Balance and Quality* (Jan. 2005), available on request from the Renewable Energy Foundation.

This sequencing and logic differs radically from that found in the *Energy White Paper*,¹¹ and still implicit in *TEC*. In particular we note that the policy continues to foreground emissions abatement as the principal goal, and thereby allows other goals to settle into subordinate positions in no particular order. We once again emphasise that by criticizing this framework we are not suggesting that emissions abatement is unimportant, but, rather, that placing it centre-stage is likely to weaken our ability to reach other essential objectives outlined in the policy, and is also likely to be counterproductive in terms of climate change outcomes.

We share general concerns about the rapidly rising concentration of CO₂ in the atmosphere contributing to a forced increase in global temperatures, and note also the risk of ocean acidification. However, Government policy as currently outlined is unduly sanguine with regard to the potential for significant mitigation in the shorter term, and thus recommends narrowly focussed policies with considerable costs and attendant risks. In fact it is doubtful whether even these policies would result in any significant climate change mitigation effect, yet *TEC*, and other Government statements, all too often seem to hold out the false promise of such mitigation. **We urge the Government to show genuine leadership with a clear statement to the effect that security of supply is the fundamental requirement for any climate change policy.** There is every reason to suppose that DTI advisors to ministers are already making this point, and we recommend that the Government heeds this advice and trusts the public to take a rational attitude to the matter.

¹¹ See, for example, *Energy White Paper: Our Energy future: Creating a Low-Carbon Economy* (Dti: London, 2003), pp. 7ff.

2 Status of *The Energy Challenge*

The status of *TEC* is unclear. While the report appears by most criteria to be a White Paper, the Government seems to treat it as a Green Paper, as can be inferred from the following remark by the Secretary of State in his address to the House:

*Many of the proposals contained in the report will need further consultation. Thereafter, the Government intend to publish a White Paper around the turn of the year.*¹²

One obvious inference from this remark is that *TEC* itself is not a White Paper.

However, many other aspects of the report suggest that it is a White Paper in all but name. The report is a Command Paper, published by HMSO, setting out the Government's conclusions following a review and consultation, and proposing a course or courses of action. While it is true that many of the details remain to be confirmed, the report is not itself a consultation as to the appropriate course of action, nor does it describe itself as a Green Paper.

While it might be argued that in essence *TEC* is a White Paper, the fact is that the Government has stopped short of using this term in referring to the work. Given the extent of the consultation behind this document, and the degree to which expectations have been raised by repeated Government references to the significance of the forthcoming Energy Review report, this lack of firm nomenclature is unfortunate.

We conclude that the indeterminate status of the document is symptomatic of indecision, and we find it deeply worrying. It is at least plausible to conclude that the Secretary of State feared that the publication of White Papers both in 2006 and 2007 would open it to charges of neurotic over-assertiveness, while the announcement of a Green Paper at this stage would smack of anticlimax. Pragmatically, it seems probable that the DTI was concerned that a clear declaration of policy intent in a 2006 White Paper would constrict the scope of the promised 2007 publication.

While we sympathise with these problems, and approve in principle of keeping the door open for further discussion, the hawing solution adopted by the Secretary of State has resulted in a report which is lacking in authority, does not invite trust, and provides little firm guidance. This is regrettable, and is particularly so since *TEC* contains many suggestions and recommendations which are in themselves prudent and worthy of support.

¹² See: <http://www.dti.gov.uk/about/dti-ministerial-team/page31953.html>
See also: <http://www.publications.parliament.uk/pa/cm200506/cmhansrd/cm060711/debtext/60711-0871.htm#06071145000002>.

3 Commentary on *The Energy Challenge's* proposals

Distributed throughout the text of *TEC* are a number of proposals relating to future policy and policy instruments. These usually appear in summary form at the conclusion of each chapter, though in Chapter 5, relating to Electricity Generation, they are presented after each sub-section. In the following discussion we reprint these proposals verbatim, indented and in italics, and then offer an extensive commentary upon them. To gain a conspectus of the Government's intentions we suggest that all the proposals be read as one continuous text before engaging with our discussion.

3.1: Valuing Carbon

TEC states:¹³

Proposals on Valuing Carbon

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

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

The Government is committed to there being a continuing carbon price signal which investors take into account when making decisions. The EU ETS will remain the key mechanism for providing this signal. The Government will continue to work with its international partners to strengthen the EU ETS to make it more effective. We will keep open the option of further measures to reinforce the operation of the EU ETS in the United Kingdom should this be necessary to provide greater certainty to investors.

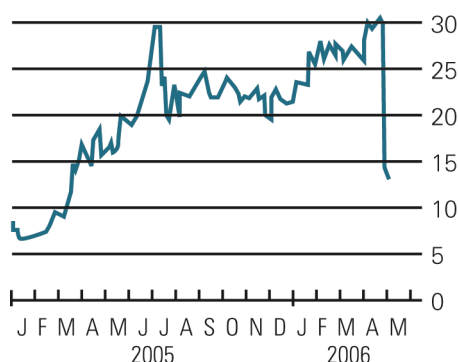
3.1.1: Carbon Trading and Carbon Taxation

It is striking that the Government continues to make carbon emission reduction the primary focus of an energy policy. We share concerns regarding climate change, but are deeply concerned at the tendency of contemporary policy to place climate change targets

¹³ *TEC*, p. 35.

before security of supply and affordability, a sequence which is likely to be counter-productive.

Furthermore, Government optimism over the EU ETS is quite misplaced. Nine years after the signing of the Kyoto Protocol and almost two years into the 'first implementation period', the Emission Trading System (ETS) which is supposed to be the high-road to economical carbon emissions reductions, gives worrying signs indicative of failure, and it is unlikely that investment decisions can be made against a commodity whose price is so volatile.¹⁴ The following chart shows price movement up to May 2006:



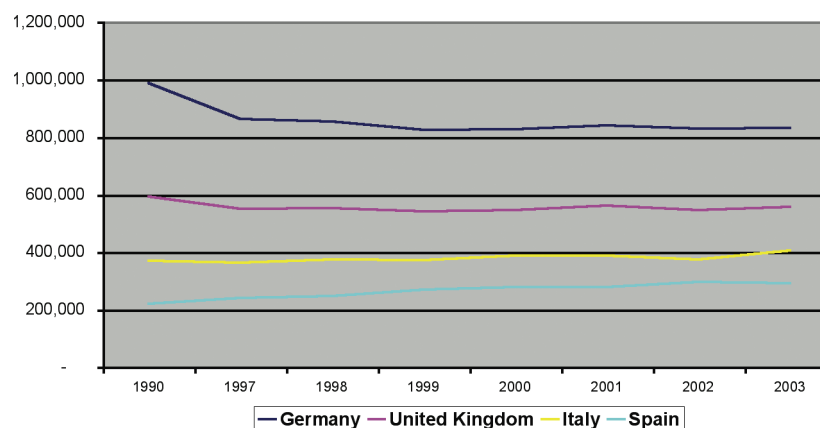
1. European Union Emissions Trading Scheme, per tonne of CO₂.
Source: Redrawn from a chart generated by Climate Change Capital.

Such instability may well be inherent to the system since the value of carbon is set politically by the member states, each of which is vulnerable by one means or another to strident and powerful lobbies, lobbies which have already demonstrated their ability to affect carbon emission caps and the way in which the burden of carrying those caps is distributed.

In fact, EU emissions of CO₂ have been rising in every year since 1999 and it now seems more likely than not that the EU will miss its own rather modest target of an 8% reduction by 2012.

The spectacular reductions in Germany were due to industrial collapse in the former GDR, a one-off and undesirable event, and the UK's significant achievements were almost entirely due to the switch from coal to natural gas, a fuel to which the UK would be ill-advised to become still more deeply committed.

¹⁴ For a sophisticated expression of similar concerns see Rory Sullivan and William Blyth, *Climate Change Policy Uncertainty and the Electricity Industry: Implications and Unintended Consequences*, Chatham House (Royal Institute of International Affairs), 2006, downloadable from <http://www.chathamhouse.org.uk/pdf/research/sdp/BP0806climatechange.pdf>



2. CO₂ emissions (tonnes) of four large EU States.

Source: UNFCCC/SBI/2005/17, 12 Oct. 2005.

UK emissions of CO₂ have been on a rising trend since 2002, caused by a market preference for electricity generation from cheap coal rather than gas, the cost of which has more than doubled during the last three years.

It is true that the UK is a major player in the EU but we question whether it has the influence and indeed the determination to ensure that the ETS will behave less like a market and more like a stable tax against which investors can make more rational decisions.

We therefore recommend that the UK demonstrates the vigour of its commitment to carbon emission reduction by implementing a carbon tax. The tax could be hypothecated to support the development of a more diverse and badly needed mix of alternative sources of energy.

3.2: Saving Energy

TEC states:¹⁵

Summary of Energy Saving proposals

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

¹⁵ TEC, pp. 59-60.

- vii) strongly urging English planning authorities to set ambitious policies on renewable energy.*
- The Government will work at international and EU level and with manufacturers and retailers in the United Kingdom to remove the least energy efficient products from the market and to build markets for the best of them by setting a firm agenda to raise standards progressively, so stimulating innovation and competition in the supply chain.*
 - We will launch a statutory consultation next spring on phase 3 of the Energy Efficiency Commitment. Prior to this we will hold an informal consultation this summer to explore whether we can extend the range of measures allowed under EEC.*
 - The Government is committed to maintaining a household obligation on suppliers in some form until at least 2020. We will do further work on the option of moving after 2011 to a supplier obligation based on tradable targets or caps for household energy demand or carbon emissions.*
 - The Government proposes that it will mandate, from 2007 onwards, improvements in the information provided in domestic customers' energy bills, requiring bills to provide comparative historic energy use, supported by information on energy efficiency.*
 - We will consult with interested parties on what further useful comparative benchmarking information can be provided and how we can cost-effectively improve the frequency at which customers are provided with accurate bills.*
 - We intend to discuss with Ofgem, the energy suppliers and interested organisations on how best to roll-out rapidly the provision of realtime displays which provide instant energy consumption and cost information on electricity use.*
 - The Government will examine the scope for more sophisticated monitoring of energy usage, and its costs and benefits, through the forthcoming trials of domestic smart meters and other forms of feedback about electricity and gas consumption.*
 - The Government will also work with interested parties to address the barriers to improved metering and billing in the business sector, including the possibility of introducing smart metering.*
 - The Government proposes to consult later this year on the introduction of a new measure for the large non-energy intensive organisations which lie outside the EU ETS and Climate Change Agreements.*
 - The Government will consider, in good time before the expiry of the current agreements, the future of the Climate Change Agreements and how we can take the objectives forward.*
 - The Government will play its part in reducing its energy demand by developing and implementing, for central Government departments, mandatory energy efficiency and sustainability procurement standards and will encourage their adoption more widely in public procurement.*
 - Beyond the immediate actions being put forward, further progress towards the Government's fuel poverty targets will depend on measures to increase*

the incomes of the fuel poor or to reduce their bills. The Government will continue to monitor the impacts of various factors on the vulnerable fuel poor and examine the effectiveness of current measures.

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

3.2.1: Energy Saving: Encouragement or Enforcement?

We support all reasonable, practical, and economic measures to save energy, and indeed believe that demand-side energy reduction measures, incentivized by making the saving of energy attractive to householders and businesses, should have been the bedrock on which this policy was founded. A simple example that could rapidly reduce the national demand for electricity would be the early replacement of tungsten-carbide filament lighting by low energy devices in every home and office, supported perhaps by a tax rebate. This obviously simple and practical measure is mentioned in the Prime Minister's foreword to *TEC*, where the potential significance is illustrated with the remark that 'If every UK household installed just three energy efficient light bulbs, the electricity saved would supply all our street lighting'.¹⁶ In addition, we note that this measure alone would significantly reduce the peak load requirement of the UK and thus remove the need for the construction of significant quantities of firm power generation, a point we expand upon below in our discussion of the proposals relating to electricity.¹⁷

Other simple measures to render demand-side reduction attractive for private householders and businesses, such as the even wider-spread use of draft excluders, double-glazing, loft and wall insulation, should be welcomed wherever these are practical. However, **we are concerned that most of the measures actually proposed by Government are legalistic, tend towards centralisation, and are certain to entail further bureaucracy.**

In essence energy saving is a simple, common sense matter and does not require further costly consultations or the use of legal instruments. Experience shows that private individuals will resent and resist intrusive determination of private affairs, and we recommend that Government should instead seek to achieve its aims with the lightest possible legislative touch. The presence of compulsion will lead the public to infer that the desired actions are not beneficial to the individual interest. In fact, when correctly applied these measures can be rewarding for households and businesses in an uncomplicated and readily appreciated way. It would be extremely unfortunate if well-meaning legislation were to result in an aura of enforced self-sacrifice around energy saving and efficiency.

Energy consumption in the transport sector has been increasing in recent years and the road transport infrastructure is inadequate even for current volumes of road traffic. Consequently, we believe that every effort should be made through the taxation system to incentivise the purchase of fuel efficient vehicles. It is regrettable that the Chancellor

¹⁶ *TEC*, p. 5.

¹⁷ See Section 3.5 below.

has chosen to reduce the differential between the cost of diesel and petrol through an increase in excise duty on the former, and we strongly recommend that this differential be widened again to incentivize the purchase of diesel driven vehicles over less efficient petrol driven vehicles.

3.3: Distributed Energy

TEC states:¹⁸

Distributed Energy: Summary of Proposals

Incentivising Community and Building Level Distributed Energy

- 1 *Government confirms its ambition to support the move towards carbon neutral developments, through implementation of the Code for Sustainable Homes and making clear that this will set the direction for further tightening of Building Regulations. Carbon-neutrality will not be possible in most developments without some form of distributed energy.*
- 2 *We will undertake a feasibility study into the Thames Gateway becoming a low carbon development area within a decade, and whether and how fast we can move towards zero carbon thereafter.*
- 3 *We will consult on the form of the third phase of the Energy Efficiency Commitment (EEC3) in the second half of this year. We will consider whether to make changes to EEC that could allow all forms of microgeneration to be eligible under the Scheme.*
- 4 *In the longer term, Government will work with a wide range of industry and consumer groups to consider whether EEC3 could be replaced with an obligation on suppliers to cap growth of emissions from the household sector. Distributed energy and energy efficiency options investments will be the most common way of achieving this goal.*
- 5 *We will shortly announce a new statutory duty on the GLA on climate change. This should give a further boost to the growth of distributed generation in the capital.*
- 6 *We will expect all planning authorities to include policies in their development plans that require a percentage of energy in new developments to come from on-site renewables, where viable.*
- 7 *We will set out proposals that provide a framework to encourage all planning authorities to take action on climate change, in the Local Government White Paper later this year.*
- 8 *We will consult on a range of options to improve energy efficiency in the large commercial sector including the option of a mandatory emissions trading scheme. This consultation will also consider whether larger Local Authorities and public bodies should be included in these*

¹⁸ TEC, pp. 74-76.

measures. If included, this would provide a direct financial incentive on these bodies to invest in low carbon heat and electricity technologies in their own buildings.

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

Large-Scale Community Heat and Power

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

Distributed Electricity Generation

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

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

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

 - licensing procedures (including exemptions);*
 - technical standards for connection and for network operation.**

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

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

Microgeneration

14 *The Microgeneration Strategy will be implemented aggressively by Government, and the powers acquired by Government under the Climate Change and Sustainable Energy Act 2006 will be exercised where appropriate. Key policies included:*

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

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

Alternative fuels for heat

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

3.3.1: Distributed Generation: Approach with Caution

We have commented extensively on related matters elsewhere in our commentary, but we note that *TEC* here tends towards an unquestioning faith in the value of distributed energy and seems to lean towards a one-size-fits-all attitude. Centralised generation has well-known merits based on its economies of scale, and in spite of line loss can offer higher thermal efficiencies. Distributed generation might in some cases be worthwhile, but the UK's society, geography, and economy is so diverse in character that successful application of distributed energy relies on appropriate use of distributed fuel, requiring tailor-made solutions.¹⁹ We fully endorse CHP, and the local generation of heat, and in some cases believe that localised electricity generation *may* have much to offer. Our concern is that the position advocated by the Government is somewhat naïve, and may lead to ineffective development and consequent disappointment.

We are also concerned that the Government seems content to pass over in silence known concerns, such as the impact on distribution networks of large scale adoption of microgeneration and consequent cost implications. Similarly, we see a lack of

¹⁹ For views critical of *TEC's* attitude to DG see Malcolm Keay, 'The UK Energy Review and Decentralised Generation', Oxford Institute for Energy Studies, June 2006: http://www.oxfordenergy.org/pdfs/comment_0606-2.pdf

precautionary realism in the absence of concern with the effect that large quantities of non-despatchable distributed electricity generation may have on the ease and costs of grid balancing. This is not to say that such problems cannot be overcome, but it would be reassuring if the question was faced squarely, not least because it would suggest a genuine commitment to this sector.

3.4: Oil, Gas, and Coal

TEC states:²⁰

Oil, Gas, and Coal Proposals

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

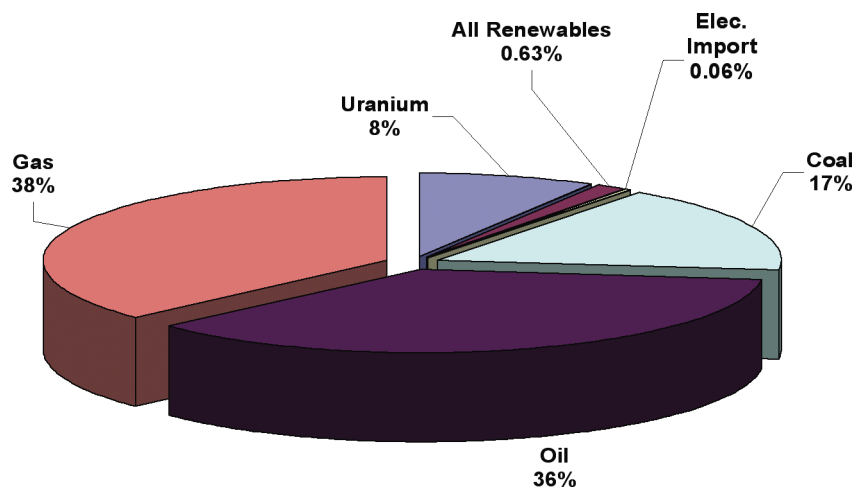
²⁰ TEC, p. 91.

3.4.1: UK Primary Energy Consumption

The Government is fully aware that United Kingdom, along with the rest of the global economy, is dependent on fossil fuel, and overwhelmingly so upon liquid and gaseous hydrocarbons. This state of affairs will persist far into the future as *TEC* itself observes:

*Today around 90% of the United Kingdom's energy needs are met by fossil fuels, and they will continue to be the predominant source of energy for decades to come.*²¹

The United Kingdom's primary energy mix is here illustrated in the following chart.²²



3. UK Primary Energy Consumption, 2005.

It is particularly noteworthy that in spite of tremendous emphasis placed on the development of 'sustainable energy' during the Government's nine year term of office, and the direction of an extremely generous subsidy stream, the Renewables Obligation, the contribution of indigenous, thus 'sustainable' renewable energy, remains modest.

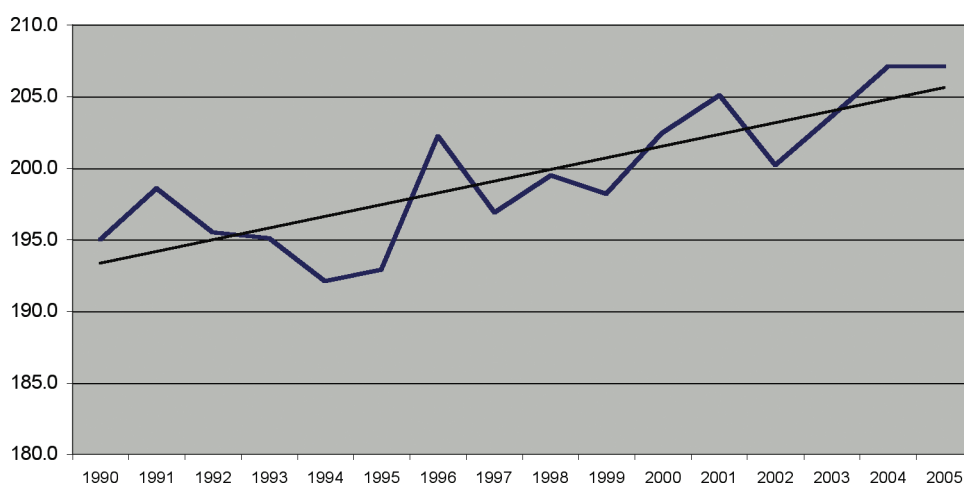
Indigenous renewable energy provided less than 1% of all primary energy used in the UK during 2005, and even if co-fired biomass, which is predominantly imported, is included is still less than 2%. Even supporters of the expansion of this sector, must be realistic about the degree to which renewable energy can contribute to security of supply, given this low baseline. The whole of the energy infrastructure is geared to fossil fuels and their manifold virtues, which due to energy densities are very considerable. The example of previous fuel transitions, coal to oil for example, is potentially misleading, and it

²¹ *TEC*, p. 78.

²² Data compiled from BP's *Statistical Review of World Energy* (June 2006), and *Our Energy Challenge* and *TEC*. The figure for uranium assumes that the full cycle efficiency of nuclear power is 33%. In fact, the real efficiency of nuclear power must take into account the energy used in mining, enrichment transport and the lengthy process of decommissioning. These are difficult figures to ascertain.

should not be assumed that renewables will, with economic incentives, be able to move forward to take the strain. In all previous transitions the successor fuel has possessed manifestly superior *intrinsic* qualities, but this is not the case with renewable energies, the merits of which tend to be *extrinsic* only. It is a matter of fact that the inherent energetic properties of fossil fuels are superior to nearly all renewable technologies, and though fossils will be increasingly disadvantaged by scarcity and difficulty of extraction resulting in increased cost, it will be some considerable time before these negatives outweigh the advantages internal to the fuel, if indeed they ever do. Consequently, it is reasonable to expect the world economy to remain dependent on fossil fuels for a considerable period of time.²³

In fact, it is not only true that oil, gas and coal supply about 92% of all primary energy used in UK (most of the remainder is the product of atomic fission), but as the following chart shows the UK's dependency on fossil fuels has been increasing, not least during the last nine years:



4. UK Primary Fossil Energy Consumption: Million tonnes of oil equivalent.

Source: *BP Statistical Review*, 2006.

This is hardly surprising, however regrettable it might be, and the trends are repeated globally. At the 2006 World Renewable Energy Congress, Mr Michael Jefferson, Chairman, Policies Committee, World Renewable Energy Network & Congresses and a former Chief Economist for Shell, remarked:

International efforts to promote renewable energy have so far been puny. [...] If traditional biomass and large hydro are excluded, 'new' renewable energy sources increased their share of World primary energy use by barely one percentage point between 1990 and 2004 (still under 2.5%). The OECD Factbook

²³ For a subtle and very well-informed prognosis of the likely character of the coming changes in fuel dependency see Peter Tertzakian, *A Thousand Barrels a Second: The Coming Oil Break Point and the Challenges Facing an Energy Dependent World* (McGraw Hill: New York, 2006).

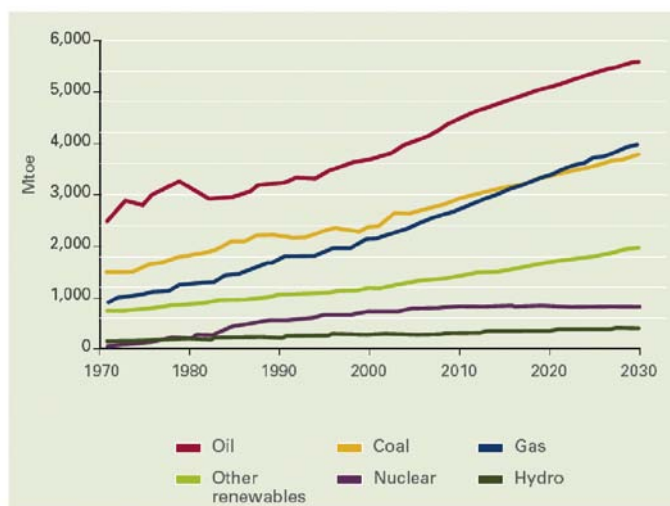
for 2006 gives a figure of 1.9% for the share of new and renewable energy in World electricity generation in 2003. For the OECD the share of new renewable energy was unchanged at 6.0% between 1990 and 2004 (OECD Factbook 2006, p. 93). Member Countries of the International Energy Agency achieved 24% of their electricity generation from renewable energy sources in 1970, but only 15% by 2001. Although supplies of renewable energy have increased – in the OECD area by 2.3% per annum between 1971 and 2004 – the rate of increase slowed markedly in the second half of the period to about 1.5% per annum. The original EU-15 Member Countries had a renewable energy share of 13.4% in electricity generation in 1990, and still only 13.7% in 2003 (the 2004 figures will apparently not be available from Eurostat until June, 2006). For EU-25 the corresponding figures were 12.2% and 12.8%, respectively. The OECD Statistics Directorate reported in March, 2006, that the UK, Ireland, and Luxembourg were among those countries where renewable energy accounted for under 2% of total primary energy supply in 2004.²⁴

Underlying these harsh facts is the correlation between economic growth and energy use, a mechanism to which the UK economy is not immune. It is a matter of historical fact that energy demand growth is greatest where economic growth is most vigorous. It is therefore the conventional, almost unquestionable, view of most energy planners in most Governments that as the international economy grows so will the use of fossil energy. That the Government shares this world view can be inferred from the fact that *TEC* presents the chart overleaf, drawn from IEA's *World Energy Outlook 2005*.

The IEA foresees the future as a more or less seamless extension of the recent past. In IEA models, demand for oil is expected to reach 4,800 million toe per year by 2010 and 5,300 million toe by 2020. Coal consumption continues to rise strongly. Demand for gas is shown to be rising even more rapidly, from 2,800 million toe in 2010 to 3,500 million toe in 2020. At this point, it is worth reflecting on the following:

- In formulating *TEC*, the Government has accepted that the rest of the world will continue to increase its use of primary energy.
- The intrinsic merits of fossil fuels suggest that in spite of increasing costs, and barring technological breakthroughs in other fields, the vast majority of increased energy will be derived from fossil sources.

²⁴ Michael Jefferson, 'Overview of Sustainable Energy Development', Presentation to the World Renewable Energy Congress, IX, 19-25 August 2006, Florence.



5. Global Energy Demand to 2030, by fuel.

Source: *The Energy Challenge*, based on data from the IEA, 2005.²⁵

- The energy in fossil fuel cannot be released without also releasing CO₂, so unless these emissions are sequestered they will add to the greenhouse gas effect.
- However, the UK, although a large consumer of fossil energy, is responsible for only 2% emissions of CO₂ globally and this proportion is set to decrease as other, larger nations increase their use of fossil fuel, in particular coal but also gas and oil.
- Consequently, any unilateral action to reduce the emissions of greenhouse gases in the UK will have only a proportionately modest effect on global emissions. Thus the quantitative reduction aspired to, whether it is 0.1, 0.2, or even the 0.6 reduction aspired to by 2050, is immaterial. The key consideration is, by contrast, the degree to which this reduction presents an economically compelling example to other states.

In view of this, the high priority that the Government seems to be placing on climate change policy is questionable. It appears likely that Government projections for supply and the cost of imported fuel may pose a much more serious challenge, and one that must be met if the UK is to have any meaningful role in global climate change policy.

TEC foresees continued and strong economic growth in the UK, and in spite of a nominal commitment to energy saving, energy use from 2006 through to 2020 is predicted to rise. However, this growth will coincide with a decline in the UK's production of oil and gas, thus transforming the UK into a net importer. *TEC* regards this prospect with a surprising degree of equanimity:

It is in gas where our demand for imports will grow most strongly, providing up to 80–90% of expected consumption by 2020. Norway will remain a significant supplier of gas to the UK in the medium term, along with Algeria and Qatar. Over

²⁵ *TEC*, p. 79

*time we are likely to import more from other potential areas such as Russia, the Caspian and Nigeria.*²⁶

We doubt that the confident tone of this statement is well grounded. Government may sincerely believe that it can achieve much, and such aims are laudable, but the opening statement of the proposal is a wish list not a practical action plan:

Our international energy security strategy will be reviewed later this year and will focus on the following outcomes:

- *Open international energy markets framework*
- *Transparency and good governance in the energy sector*
- *Effective international contingency arrangements to guard against physical supply shocks in world oil markets.*
- *Political and economic stability in source and transit regions.*

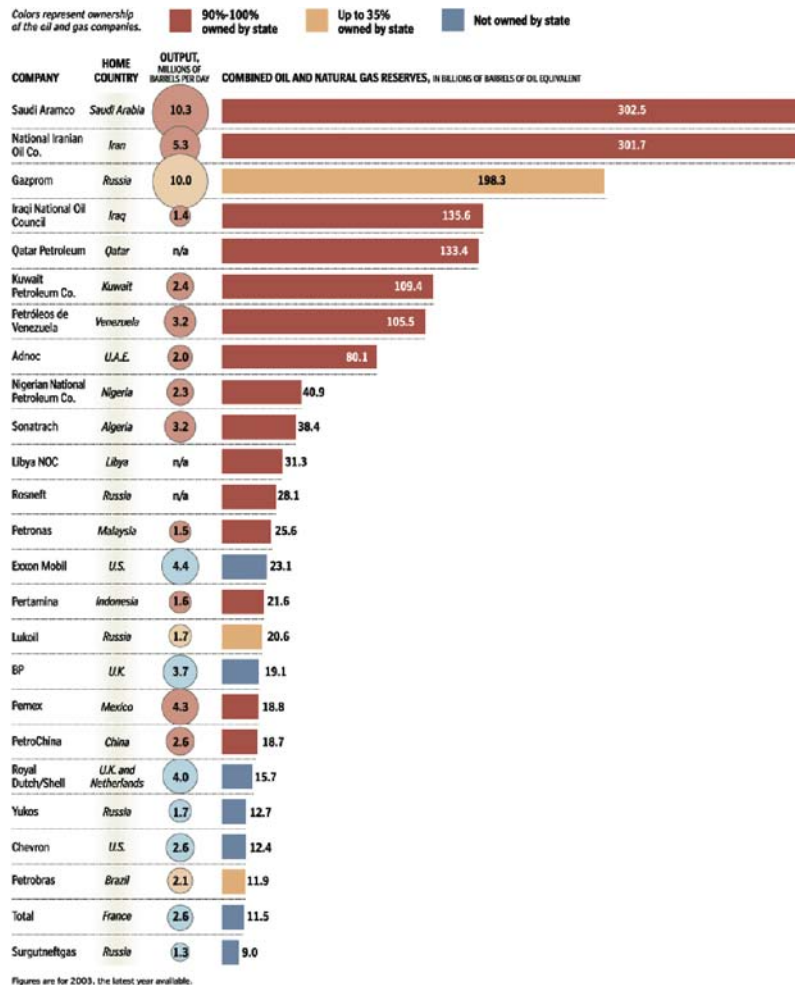
The weakness of these remarks can be exposed by a moment's reflection on the geopolitical facts. As regards the supply of fossil energy and with the exception of coal the OPEC countries and The Russian Federation contain 85% of declared remaining oil and 77% of remaining declared gas reserves.²⁷ The UK cannot be immune to disturbances in the markets of these suppliers. The Government is correct in wishing to ensure that these markets should be open, transparent and well governed, but the contemporary reality is that the reserves of most major energy suppliers are controlled by national oil companies whose operations and company ethos are aggressively resistant to any degree of foreign steering let alone ownership of energy reserves.

The geopolitics of fossil energy supply are likely to be the defining theme of international politics and trade during the next two or three decades. It is to be hoped that the public posture of the present UK Government as revealed in the statement of its aspirations does not reflect its true understanding of security of supply. It would be naïve to believe that UK Government can influence global events and policies significantly. Indeed, it is conceivable that we have little or no influence at all.

Daily events tend to underline this point, and it seems unlikely that Russia or the nations of OPEC will open up their markets to OECD-owned energy companies in the way that *TEC* expects. This is a position effectively accepted by the international oil companies, such as Exxon Mobil, BP, and Shell, all of which are struggling to find a new role as they are progressively marginalised by the scale of state-owned national companies, as illustrated in the following chart:

²⁶ *TEC*, p. 78.

²⁷ BP, *Statistical Review 2006*.



6. State Ownership of Major Oil and Natural gas Companies and Reserves.

Source: *Washington Post*.²⁸

Indeed, it is clear that energy nationalism of the most populist kind, while inimical to the interests of overseas consumers, is genuinely popular in Saudi Arabia, Iran, Venezuela, and Russia. This is predictable, intelligible, and may even be rational and prudent. We should not expect that it will be easy to persuade those states to adopt any other position.

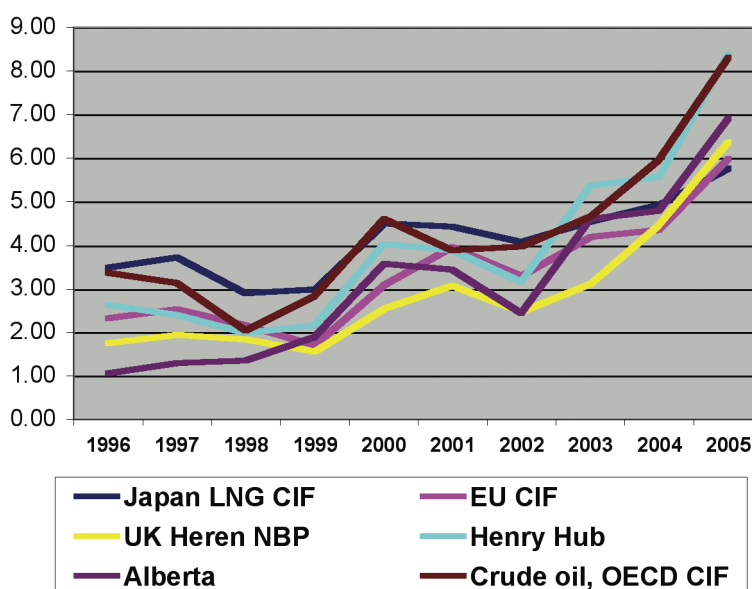
3.4.2: DTI Energy Price Projections

Price is so crucial a characteristic of energy that informed predictions form the bedrock of any policy. It is therefore entirely reasonable to ask whether the DTI’s assumptions in this regard are well-reasoned and robust. Unfortunately, we cannot give a confident endorsement of the projections currently informing Government planning. We do not pretend to have any privileged information about hydrocarbon reserves and future prices, but, as the subsequent section will show, there is considerable and informed international

²⁸ <http://www.washingtonpost.com/wp-dyn/content/graphic/2005/08/03/GR2005080300605.html>

debate at the highest levels of responsibility over both the quantities of hydrocarbons which can be extracted at lower costs and the prices likely to be commanded in a seller's market.

We are consequently concerned that the Government has avoided direct reference to these now widespread concerns over the future availability and therefore the cost of fossil resources. We can only hope that appearances belie real commitment, but feel compelled to note that *TEC* appears open to the charge that it is optimistic about the future prices that the United Kingdom will have to pay for imported hydrocarbons. The following chart, drawn from data in the *BP Statistical Review 2006*, records recent energy price history:



7. Gas and Oil Price Convergence, \$/GJ.

Source: *BP Statistical Review*, 2006.

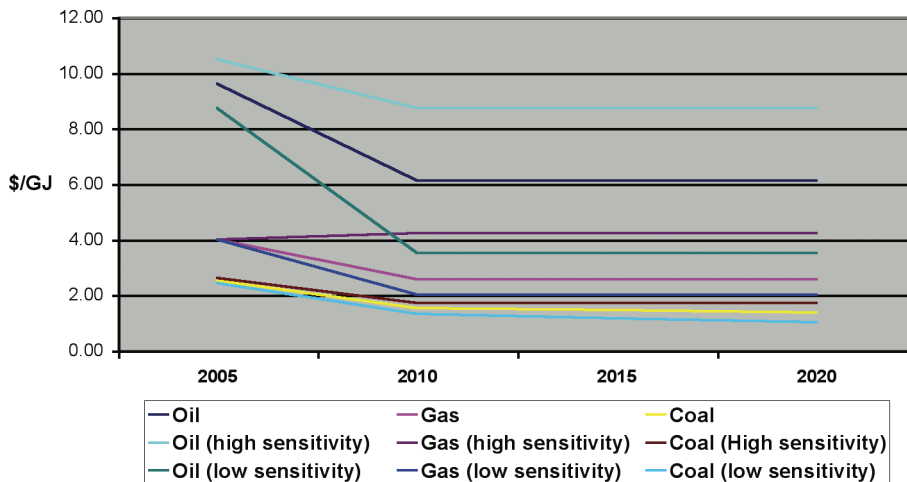
Ten years ago, gas was predominantly sold in the region of production, while oil was being traded as a global commodity, and prices were consequently widely separated. However, as the chart indicates there is both volatility and a tendency towards convergence.

As pipelines continue to be built, and LNG becomes a significant fraction of all gas sold, gas is also becoming a global commodity. The chart shows that the spread between the highest and lowest priced fuel narrowed over time from 69% in 1996 to 31% in 2005. It seems likely that over time this spread will narrow still further.

Indeed, there are excellent reasons for believing that gas may become more expensive than crude oil. The physical reality of oil is that it is often a dirty raw material which is difficult to handle and expensive to refine, whereas gas is comparatively clean and simple to bring to market. Furthermore, the use of gas for the synthesis of high quality liquid transport fuels and other valuable hydrocarbons is likely to grow, and it

seems likely that by 2015 production will rise to more than one million b/d. This would, admittedly, still be less than 1% of all transport fuel in 2015, but the absolute quantity is large, and its effects on gas demand cannot be ignored.

However, these considerations do not appear to have any impact on the DTI’s thinking in relation to future price, at least that thinking which it makes public. As a prelude to its work on the *Energy Review* the DTI’s Energy Strategy Unit updated its energy and CO₂ emission predictions for the third time in the last four years.²⁹ The following chart has been calculated from the data appearing in the section ‘Fossil Fuel Price Assumptions’.³⁰ It should be noted that while the DTI uses various units (\$/bbl; p/therm; £/tonne) we have converted all these to \$/GJ to facilitate comparison:



8. DTI Fossil Fuel price projections, Feb. 2006.

We suggest, as a thought experiment, that the reader puts aside the reputation of the consultancies responsible for these estimates, and instead simply places the DTI’s projections into the context of recent history and contemporary world events. Having performed this exercise ourselves we believe that many will agree that the DTI seems to be relying on counterintuitive projections.

The track record is not encouraging. All the assumptions published since 2002 have predicted that prices will fall from the date of publication and reach historical averages in the period 2010 to 2020. Yet, each succeeding projection (2004, 2005, 2006) has acknowledged that prices have in fact risen since the previous publication, thus entailing that the current year’s projection must be adjusted to reflect the changed circumstances. Remarkably, in each case the DTI then reverts to its optimistic long term position and

²⁹ DTI, *UK Energy and CO₂ Emissions Projections: Updated Projections to 2020* (February 2006). Available from: <http://www.dti.gov.uk/files/file26363.pdf>. For other projections work see: <http://www.dti.gov.uk/energy/environment/projections/index.html>.

³⁰ Pp. 14-18.

proposes that from thenceforward prices will fall to around the historical average and remain stable in real terms for the following decade. This is decreasingly credible.

In stark contrast to the DTI's price projections are those of the forward market as traded daily at the New York Mercantile Exchange (NYMEX).³¹ On 21st July 2006, the forward curve for crude oil showed January 2011 crude oil at \$70/b. This should be contrasted with the 'high sensitivity' DTI price projection of \$50, and the two 'central' (by which is presumably meant 'most likely') cases showing \$35. Similarly, the NYMEX forward gas price for the winter of 2011/2012 shows a price of \$9/mmBtu as compared with the DTI's central case of \$5/mmBtu and the 'high' case, favouring coal, of \$6.8/mmBtu. One DTI scenario still projects 18p/therm (roughly \$3/mmBtu) in 2010.

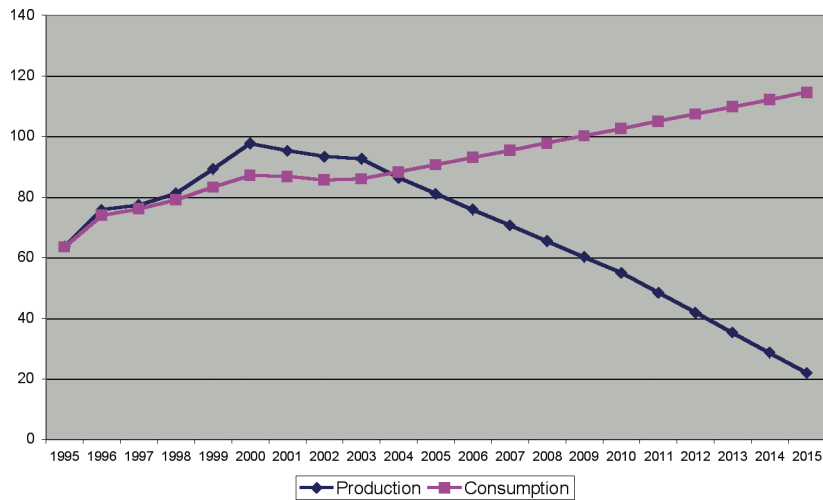
The prediction of market prices is, of course, of extreme difficulty, and we can certainly hope that the DTI's confidence is proved to be correct, and our own concerns misplaced. However, the forward prices indicate the behaviour of actual funds, and must give the gravest cause for concern. In formulating policy for an uncertain future, it is perfectly valid to consider optimistic scenarios, but it is equally necessary to ensure that any policy outcome is robust against a less favourable eventuality. The Government appears to be overly reliant on the assumption that we are living through a period of temporary supply tightness in hydrocarbons, and that production will rise comfortably to meet demand as fresh capital is invested in oil and gas exploration, thus leaving market forces to restore prices to historical average levels. However, it is also reasonable to infer that there is a significant probability that this happy conjunction of events will not materialize. Nowhere in *TEC* is the comfortable and comforting view queried or put into context. Admittedly, many OECD administrations seem to prefer an ostrich-like approach to the rapidly diminishing diversity of oil and gas supplies, but this can only be a weak apology for a lack of prudence on the part of the UK Government. **The general public has a right to expect that Government will discharge its duties in regard to national security by planning for unfavourable and worst-case scenarios, even if these are regarded as of low probability. At present the Government appears to be negligent in this respect.**

3.4.3: Gas

3.4.3.1: Import Dependency

As is well-known, and acknowledged by Government, the United Kingdom's short period of energy independence is over. Production of oil and gas from the UK Continental Shelf is now in decline, and the UK is moving rapidly into the position of being a net importer of energy. The following chart shows clearly that the Government expects the United Kingdom gas consumption will increase and that this will be achieved through imports.

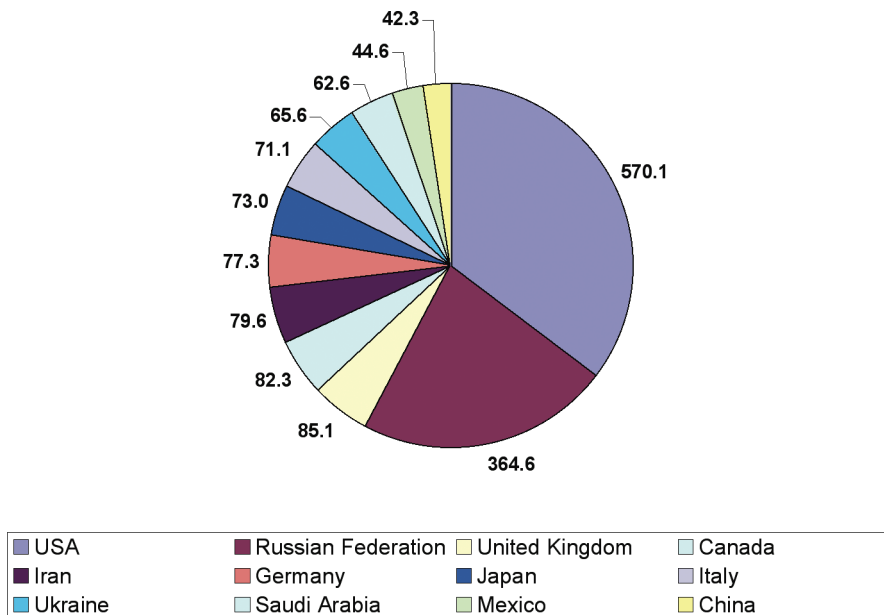
³¹ <http://www.nymex.com/index.aspx>



9. UK Production and Consumption of Natural Gas, million tonnes of oil equivalent per year.

Source: BP Statistical Review 2005, DTI, *Our Energy Challenge*.³²

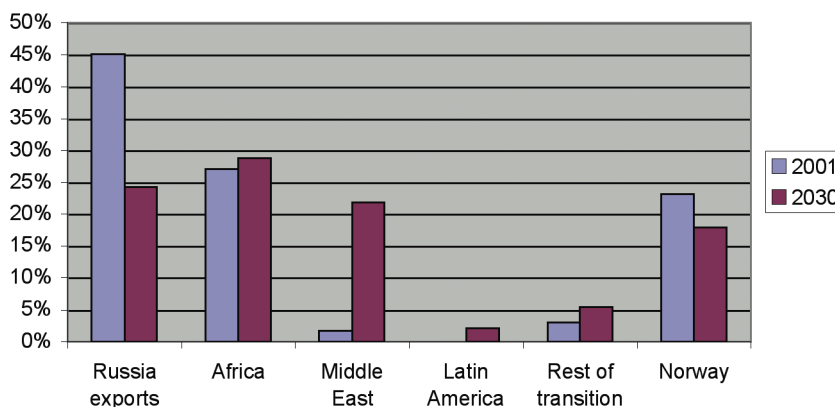
Imports on this scale will render the United Kingdom one of the largest importers of gas in the world economy, representing a remarkably rapid reversal of roles. In 2005, the United Kingdom was the world’s third largest gas consumer after the USA and Russia, but supplied its needs from resources under sovereign control.



10. Top 12 Global Gas Consumers, 2005 (million tonnes of oil equivalent).

³² Data up to 2004 from BP’s *Annual Statistical Review of World Energy*: data and projections 2006 onwards from the Energy Review consultation document, *Our Energy Challenge*, p. 36.

Its new dependence upon sources as far away as Qatar, Algeria and Eastern Siberia can only be a point of grave concern, and requires more thoroughgoing planning than is made manifest in *TEC*. However, data charts embedded in presentations distributed on the DTI website suggest that Government is aware of the facts of the matter, a fact which makes the absence of statement in *TEC* all the more puzzling. The following chart calculated by DTI but derived from IEA data, shows that in view of declining Russian and Norwegian exports EU and therefore UK gas demand will be met, if it is to be met at all, by increases in imports from the Middle East. These increases appear improbably large.



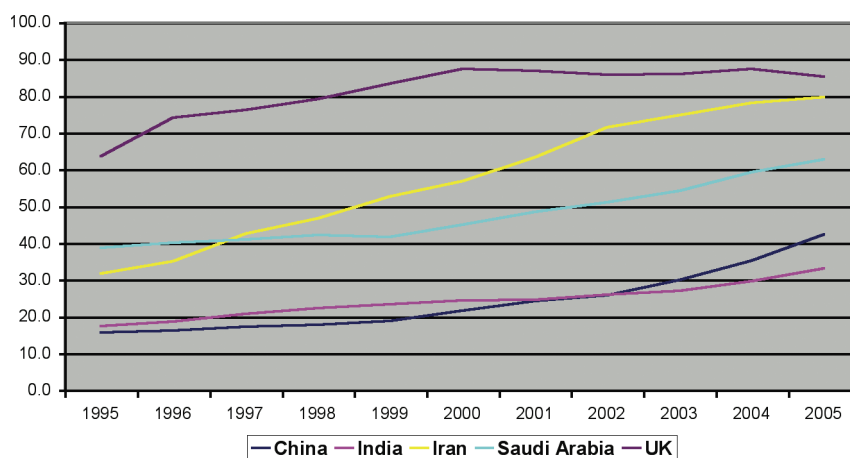
11. EU Imports of Gas 2001-2030.³³

Furthermore, experience during the winter of 2005–2006 showed that the United Kingdom system was able with only the narrowest of margins to cope with moderate glitches in supply from continental Europe, and in any case experienced large price spikes. The UK Government was inclined to blame lack of competition in European markets for the fact that these prices failed to draw gas across the inter-connectors. However, while advances in the liberalisation of markets would doubtless be worthwhile, it is generally misleading to suggest the market failures were the principal cause of the UK's difficulties. A more plausible and widely accepted account notes that continental suppliers were themselves bound by contracts and had little gas to spare. The mere existence of a pipe and a price differential cannot guarantee the flow of gas.

Some of the United Kingdom's competitors for the purchase of natural gas are also major producers. In this important category we find Saudi Arabia, Iran, and, principally, Russia, which currently supplies over 30% of Europe's natural gas and may supply over 50% by 2010. China's increase in gas use between 2004 and 2005 was 20%, following an increase of 17.4% the previous year. There are only slightly lower consumption increases for India and Iran. The rapid increase of gas consumption in the Middle East

³³ Chart available in the embedded spreadsheet in the presentation given to the third stakeholder seminar by Paul McIntyre under the title 'Security of Supply'. Downloadable from <http://www.dti.gov.uk/energy/review/seminars/page25171.html>.

(regional increase in use was 6.7% for 2005 over 2004). This key exporting region now accounts for 226 million toe gas consumption and 9% of global gas demand, as is shown in the following chart:



12. Some Global Gas Consumers (million tonnes of oil equivalent per year).

Russia's recent economic resurgence is largely based on its reserves of both oil and gas, and benefits particularly from the high prices that it is able to command as the output of European gas producers declines.³⁴ In addition, as Russia becomes more prosperous it is likely that domestic demand will increase, a phenomenon well documented in the United Kingdom during the 1980s and 1990s. Even a small increase in domestic Russian demand may lead to export constraints similar to those which occurred during the extremely cold winter of 2005–2006.

In summary, the principal point to take here is that while there are many customers for gas, there are few suppliers, and inter-consumer competition is inevitable. When one of those consumers is also a supplier the outcome may not be favourable to external customers.

As regards gas supply, the United Kingdom has been operating and still operates on a 'just in time' philosophy. This was adequate as long as there was surplus production capacity from the North Sea. *TEC* recognizes that the United Kingdom will need gas storage in the event of supply disruptions at any of its existing or planned gas inter-connectors. Details of the UK's plans for gas storage are provided in *TEC*, and show that from 2007 it is hoped that a further 2.8 billion cubic metres will be added to the existing storage operated by Centrica at the offshore Rough gas field, making 4.8 billion cubic meters in all.³⁵ This will provide 19 days storage at an average rate of consumption, but

³⁴ The temporary exception is Norway whose oil production has already peaked and whose gas production will peak around 2019. Norway has been exporting gas to Europe for two decades and is effectively cooperating with OPEC in controlling hydrocarbon production. Peak oil and gas production is long past in the Netherlands.

³⁵ *TEC*, p. 88.

less than 10 days at winter peak rates. From 2010, *TEC* foresees storage capacity rising to 7.2 billion cubic metres. This is only adequate for approximately twenty-eight days of average consumption, and considerably less than a fortnight at peak, winter consumption.

This new capacity may be enough to reduce short-term spikes such as those experienced during the winter 2005–2006 but it will not enable the United Kingdom to maintain energy supplies to consumers, including electricity generating companies, during any long term (e.g. politically caused) supply disruption, nor will it permit the UK to benefit from seasonal price swings.

In this regard, it is noteworthy that average coal stocks kept at United Kingdom power stations are equivalent to three months' demand, and that although the United States is less vulnerable than the United Kingdom to problems with imported gas, its storage capacity at the end of 2004 was sixty-one days at average demand rates.³⁶

Considering the central role that gas is presumed to play in the future market, the high rate of depletion in the North Sea and the many possibilities for disruption of supply, we see strong reasons why much more gas storage should be built and ways found for incentivizing the large investments required.

It would be in the best interests of EU consumers if Russia could be persuaded to sign up to the *Energy Charter Treaty*, under which there would be more open access to its gas and oilfields. EU companies would enjoy extraction rights across national boundaries, while disputes would be addressed through international courts.³⁷ However, Russia has already shown reluctance to become a full signatory, and it is extremely unlikely that any OPEC country will do so. Russia's motivation is plain. If it acceded to the treaty it would lose sovereignty as well as the ability to cartelize energy prices and to employ its advantageous position as a political tool, not just with its immediate neighbours but also with new energy customers in the east and the west. This would be deplorable for EU consumers, but it is unsurprising that Russian policy is taking this direction, and naturally enough such a policy will be domestically popular.

A strong indication of the way this policy will manifest itself in practical action was revealed by Russia's response to EU pressure after the Ukraine disruption in January 2006. Attempts to exercise consumer leverage provoked retaliatory measures and a new-found determination to diversify and expand Russian gas sales to Japan and China while also entering the LNG market. In this stern, indeed harsh, context *TEC* appears to be, in spite of its good intentions, indulging in wishful thinking. We quote:

An open international energy markets framework

[...]

We will also work to remove barriers to enable both producing and transit nations to join multilateral treaties such as the European Energy Community Treaty and the Energy Charter Treaty. These instruments establish rules which

³⁶ http://tonto.eia.doe.gov/dnav/ng/ng_stor_cap_dc_u_nus_a.htm.

³⁷ <http://www.encharter.org/index.jsp> mentioned in passing in *TEC*, p. 83.

govern trade and investment in energy and related equipment, and enable disputes to be resolved through law.

Transparency and good governance in the energy sector

- Transparent, accurate and timely data help the market function effectively, allowing prices to signal the required levels of investment. We will therefore continue to promote the Joint Oil Data Initiative (JODI) as a credible mechanism for the exchange of oil market information; and explore with our international partners how the publication of objective data might similarly improve the way in which gas markets function.*
- We will continue to promote the Extractive Industries Transparency Initiative as applicable to all energy resource-rich countries.³⁸*

Unfortunately, it is far from certain that we have sufficient influence with Russia to give these abstract and generalised aspirations any substance in the real world. Similarly, while the Government's remarks are clearly intended to protect the interests of the United Kingdom it is difficult to see what means we possess to enforce these wishes. The unhappy fact is that in a seller's market energy customers are in an extremely weak bargaining position.

The extent of these problems can be best appreciated from engagement with geographical facts. *TEC* implicitly recognises that the fuels on which we will continue to depend are for the most part distant, and itself presents the following chart showing the disposition of remaining global gas reserves:



13. World Proven Reserves of Natural Gas (2004).

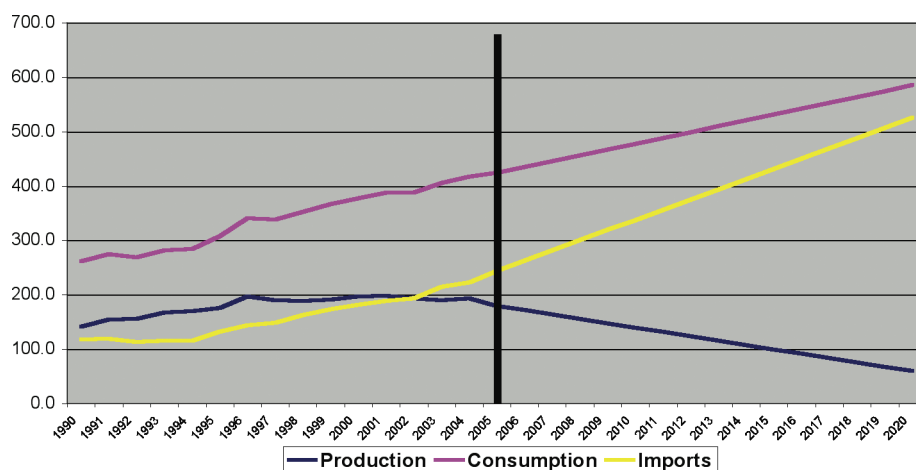
Source: Cedigaz.³⁹

³⁸ *TEC*, p. 82.

³⁹ *TEC*, p. 79.

In 2005 the UK was the fourth largest sovereign gas producer, after Russia, the USA and Canada, and it is unsettling to note while production is now rapidly declining it remains the world's third largest consumer of gas. It will be subject to considerable competition for supplies, not only from its EU neighbours but also from rapidly growing gas consumption in producing countries such as the Russian federation, Saudi Arabia, and Iran.

Bearing this in mind it is clear that if Government wishes to influence the geopolitics of oil and gas it should not underestimate the difficulties, and, critically, it should not overestimate the ability of the EU to act effectively for the European consumer, whose needs are already large. The following chart represents actual data to 2005 from the BP *Statistical Review* (indicated by the vertical black bar), with trend line projections to 2030, where consumption increases at the rate of 10.75 million toe/yr, and production declines at 8 million toe/yr:



14. EU 25 Natural Gas Projected to 2020: Production, Consumption, Imports.
Data to 2005 from BP *Statistical Review 2006*. Projections to 2030.

In this context, which is of rising need and falling domestic production, it is entirely reasonable to ask whether imports will grow smoothly to meet demand. Early indications are not encouraging, and a sobering article in *The Petroleum Economist* of July 2006 quotes the Chief Executive of Eni, the leading Italian energy company, casting doubt on the ability of Russia or LNG to supply gas in sufficient quantities:

At last month's World Gas Conference (WGC) in Amsterdam, Paolo Scaroni, Eni's chief executive, said: 'If we don't address the structural problems that threaten the availability of gas in Europe and start managing demand, we risk an authentic shortage.'

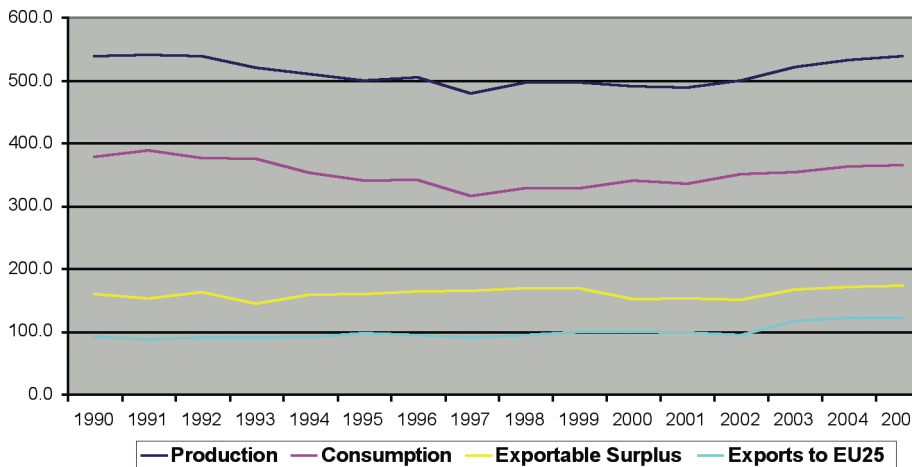
According to Scaroni, policies in the European Union (EU) that discourage coal and nuclear generation, combined with declining domestic gas output, means the import requirement could hit 220bn cm/y by 2012. Even including Gazprom's plans to export gas through the North European Gas Pipeline (NEGP) to Germany,

the Medgaz link from Algeria to Europe, and Norway's Langeled project, no more than 90bn cm/y of gas will reach the continent through pipelines by 2012.

The remainder would have to come from LNG – meaning Europe would need at least another 12 new import terminals. ‘Then we would need gas and liquefaction capacity’, says Scaroni. ‘That’s the real bottleneck in the LNG chain.’

Europe has only contracted for 60bn cm/y of LNG to 2012, leaving a supply gap of about 70bn cm/y. [...] Scaroni says the increased fluidity of the LNG market might not offer any solace to Europe, either, given that it will enable suppliers to sell to the markets that pay most. This, says Scaroni, will leave EU countries ‘in the uncomfortable position of being buyers in a sellers’ market’.⁴⁰

Little comment on this seems necessary, and closer engagement with the details of Russian production supports Scaroni’s concerns. While it is true that Russia exported over 100 million toe of natural gas to the EU 25 during 2005, some 29% of EU demand, this simple fact may distort our understanding of future prospects. The history of gas supply during the last fifteen years, as represented in the following chart, suggests that if Russia continues to supply the former Soviet Union states, then export capacity will be limited unless production rises substantially.



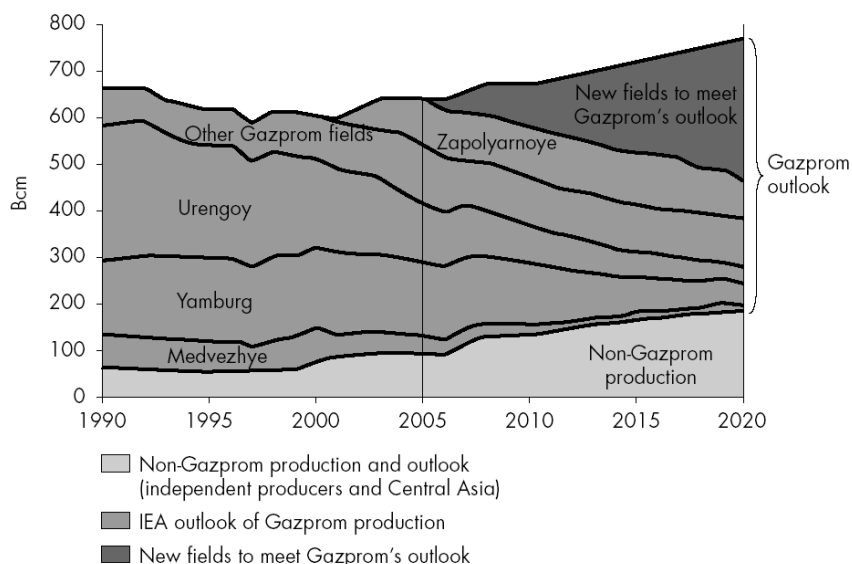
15. Russian Natural Gas Production and Consumption (mtoe).

Source: *BP Statistical Review*, 2006.

The question is whether such an increase is likely, and those seeking answers in the IEA’s recent major study *Optimising Russian Natural Gas* will find few reasons to be sanguine. Of particular note is the following chart, which suggests that rapid declines at Gazprom’s largest gas fields will make it difficult to increase overall production in the short

⁴⁰ Derek Brower, ‘Speaking different languages’ *The Petroleum Economist* (July 2006). <http://www.petroleum-economist.com/default.asp?page=14&PubID=46&ISS=22121&SID=638921>.

term, and that long term increases are wholly dependent on the development of new fields.



16. Russian Gas Supply Outlook.

Source: IEA Estimates. ©OECD/IEA.⁴¹

However, there are indications that Gazprom will decline offered technical assistance and investment aimed at increasing production unless the EU is prepared to sign up for long term supply contracts, something which the EU opposes in principle on the grounds that suppliers' prices should always be reflective of current market conditions and therefore subject to change at short notice. The pressure brought upon Gazprom to accede to this requirement, and the cold shoulder it received over the issue of its intention to purchase European down-stream assets, seems to have enraged its management. Gazprom is now actively involved in opening up its business to pipeline customers in the Far East, and has also become involved in the LNG trade, which will diversify its customer base and shift its business focus away from piped gas for Europe.

We therefore conclude that EU reliance on increased deliveries of Russian gas by pipeline is unwise. Nor are we convinced that there is any robust solidarity binding the EU's energy customers. Indeed, the bilateral agreement reached in September 2005 between Germany and Russia over the North European Gas Pipeline suggests that this is already under strain. If Gazprom chooses to fill this new pipeline and reduces exports through Ukraine and Poland, then the darkest fears of Russia's neighbours, among them newly joined EU countries, will be fully justified. Last winter, when Russian exports were restricted by domestic demand, Germany refused to deliver short-fall gas to Italy preferring to keep this in storage. The failure of gas to flow across the interconnector to

⁴¹ IEA *Optimising Russian Natural Gas: Reform and Climate Policy* (July 2006). Available for purchase from http://www.iea.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=184

the UK, in spite of higher spot prices, has provoked UK Government complaints, but in fact this should surprise no one. Continental suppliers were concerned for the well-being of their own long term customers, with whom, and for good reasons, they have uninterruptible contracts. Several EU states, including the UK, are already worryingly and increasingly dependent on gas. Spain's consumption of natural gas, for example, rose 21 per cent in 2005, with a 75.4 per cent in the demand of the electricity generation sector.⁴² Such pressing needs in all EU states, not least the UK, will test commitment to equitable treatment of other partners.

The fundamental question, then, is whether LNG can sustain the EU-25's annual 19–20 million toe per year increase in imports through to 2020? A confident answer is beyond any commentator, but the pessimism of leading European energy executives such as Eni's Paolo Scaroni, quoted above, is suggestive. Such downbeat views seem all the more plausible when we recall that the successful expansion of imports through LNG requires not only the year on year discovery of new gas, but also successful efforts to persuade producers to export rather than letting the reserve remain in the ground and appreciate in value or, still more likely, process gas domestically for petrochemicals and high value transport liquids. Such concerns are more than merely theoretical. Qatar, for example, is already committed to delivering 70 million tons of LNG per year, but will also soon be the world's largest manufacturer of gas to liquids, and has recently announced plans to smelt aluminium on the grand scale.⁴³

Even if these rivals to gas export were wished away, the successful co-ordination of the growth of the LNG industry would be a source of anxiety. The financing and delivery of liquefaction trains in supplier countries, the construction of specialised tankers, and the continued expansion of importing terminal in receiving countries must all go hand in hand if bottlenecks and delays in deliveries are to be avoided. Given the frenetic degree of LNG infrastructural development activity in Europe, as shown by the following map, occasional hiccoughs seem inevitable:

⁴² Point Carbon, 29.08.06. <http://www.pointcarbon.com/Home/News/All%20news/Energy%20&%20Emissions/article17343-479.html>

⁴³ http://www.hydro.com/en/press_room/news/archive/2004_12/qatar_main_en.html



17. Infrastructural development for Liquefied Natural Gas in Europe.

Source: *Oil & Gas Journal*.⁴⁴

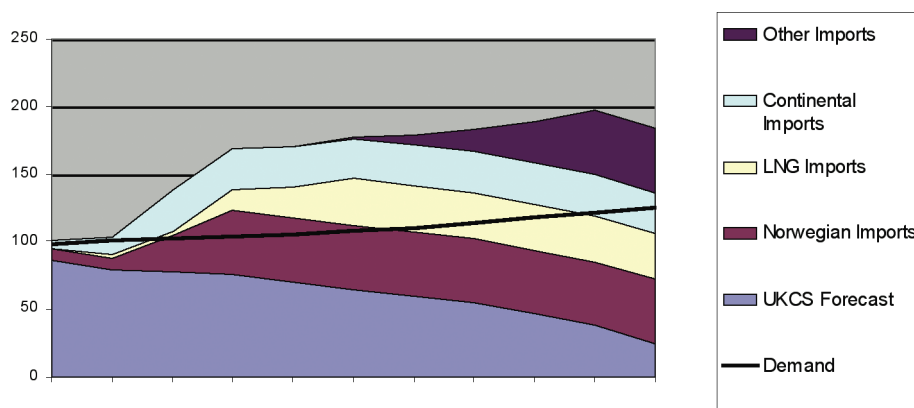
The UK Isle of Grain LNG import facility is currently operational, with a capacity of 3.3 million tonnes of per year, and it is hoped that this will be supplemented by 2007 with a further 12 millions tonne per year capacity in Pembroke and the commissioning of the Langed pipeline. However, it should be noted that if supply shortfalls are to be avoided in the winters leading up to 2010 it is essential not only that these great construction projects can be completed on schedule but that the corresponding export structures are also provided in a timely fashion. But even this may not be enough to protect the UK against price shock. We share the view expressed in *TEC*:

*This risk of 'tightness' in the balance between demand and supply could lead to relatively high and volatile prices, which could have a considerable impact on the economy. In fact, if new infrastructure is not forthcoming or is delayed, there is a risk of price rises, costing consumers hundreds of millions of pounds.*⁴⁵

It is regrettable that remarks such as this did not have a larger governing role in the formulation of *TEC*. It should be noted that difficulties are already occurring, and that during the winter 2005–2006 LNG carriers were diverted from the Isle of Grain by higher prices elsewhere in the world, a phenomenon also known to have occurred in Spain. There is no reason for thinking that the UK will be immune from repeated difficulties of this sort in the years ahead as the rest of Europe also becomes heavily dependent on LNG. The DTI's projections appear to be based on assumptions implicit in the chart overleaf, where rising UK demand is met and exceeded by a wealth of imports to compensate for falling UK Continental Shelf production.

⁴⁴ "LNG Observer", *Oil & Gas Journal* (July-Sept. 2006).

⁴⁵ *TEC*, p. 87.



18. UK demand for gas and import sources, 2004 to 2015.

Source: National Grid Transco, 2005.⁴⁶

The importance of anticipated Norwegian exports in providing a margin of security, particularly in the short term, is a salient feature of this chart. However, Norway's traditional customers in Europe will also be adversely affected by tightness in international gas supply, and this may place considerable strain on that country's ability to export to the UK. The chart provides similarly superficial reassurances with regard to the medium and longer term, the uncertain nature of the critically important 'Other Imports' bleeding the scenario of any comfort it might offer.

3.4.3.2: Gas: Conclusion

Nothing else in *TEC* gives so much cause for anxiety as the continued drift towards an overwhelming dependence on imported gas. In common with many other commentators, the Renewable Energy Foundation raised this matter in earlier publications, and made strong criticisms of the 'wind-plus-gas' policy advocated by the Energy White Paper of 2003. While Government now seems aware of some aspects of this problem **we cannot see evidence of the resolute determination needed to conserve North Sea stocks, ensure imports, and reduce gas dependency via an emphasis on the clean utilisation of alternative fuels, particularly coal.** It should be obvious that renewables can contribute to this effort, but it is equally obvious that care must be taken so that the technologies adopted do not bring in their wake an unintended dependence on gas.

3.4.4: Oil

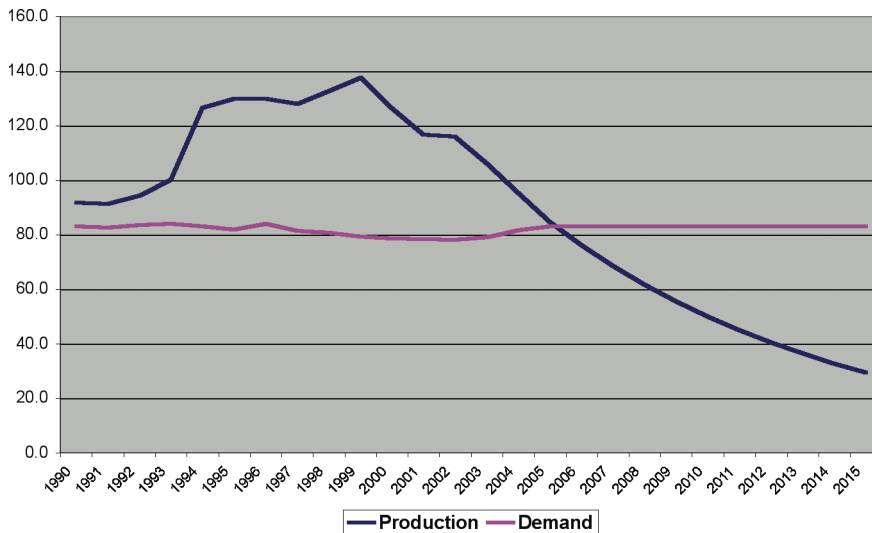
3.4.4.1: Import Dependency

Concerns over the cost and availability of gas can be echoed in regard to oil. It is encouraging to note that the UK's consumption of oil, the dominant fuel for transport, has stayed more or less constant despite the large increase in road traffic. This is partly the

⁴⁶ Chart drawn from Paul McIntyre, 'Security of Supply' (DTI Stakeholder Seminar). Downloadable from <http://www.dti.gov.uk/energy/review/seminars/page25171.html>.

result of increased vehicle efficiencies, and in part the outcome of a switch from oil to gas in the heating sector. An overall decline in the petrochemical sector, and a reduction in the use of oil-based feedstock, are other important factors.

Nevertheless, as the UK slips into net import dependency, with production falling at around 11% per year, the prospect of relying on overseas suppliers, however diverse geographically and politically, must give extreme cause for concern, particularly so when it is recalled that the overwhelming bulk of the remaining reserve is situated in Russia and the Persian Gulf. Indeed, Russia and the Middle East contain 70% of remaining reserves of conventional oil and 67% of proven reserves of gas,⁴⁷ and it is to these sources that the UK will inevitably be looking in the future. The following chart of UK production and demand indicates the size of the shortfall to made up from imports.



19. UK Oil Production and Demand.

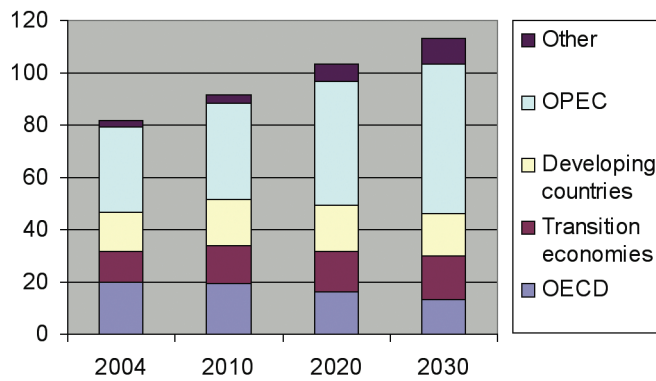
Data to 2005 from BP, *Annual Statistical Review 2006*.

Subsequent trends based on UKOOA and DTI Projections.

In view of the state of global oil production it is prudent to assume that these imports will come from a small range of suppliers. Non OPEC oil production, including Russia's, is thought likely to peak from around 2012,⁴⁸ a fact which must be clear to DTI since it is evident in the following chart embedded in a presentation distributed on the DTI website:

⁴⁷ BP, *Statistical Review of World Energy* (2006).

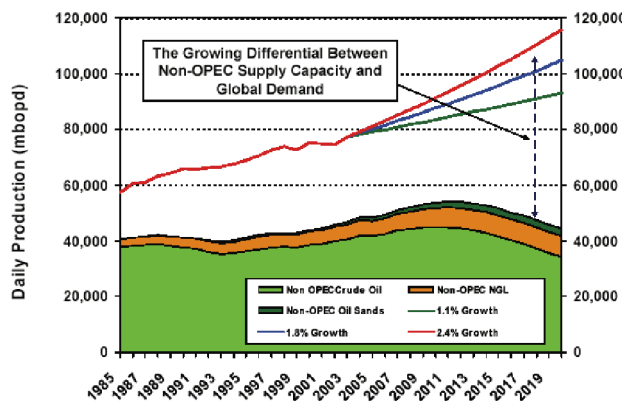
⁴⁸ 'Energy Challenges, The Non OPEC Decline', *Oil & Gas Journal*, 21 Feb. 2005. Imam, Startzman & Barufet, 'Multicyclic Hubbert model shows global conventional gas output peaking in 2019', *Oil & Gas Journal* (16 Aug. 2004).



20. Global Oil Production 2004 to 2030.

Source: DTI.⁴⁹

Note that the summed production from Developing countries, Transition economies and OECD is projected to peak and decline between 2010 and 2020. In view of this the bulk of global demand must be met by additional output from OPEC countries, though there are grounds for fearing that the scope for increased production may be limited by political as well as geological reasons.⁵⁰ The problem is given clear expression in the following chart published by the Washington-based oil consultants PFC Energy, and showing global demand under three different growth scenarios, and Non-Opec production from crude oil, oil sands, and Natural Gas Liquids.⁵¹



21. 'The Problem – The Expected Growing Gap Between Global Demand and Global Non-Opec Supply in the Next Decade'.

Source: PFC Energy.⁵²

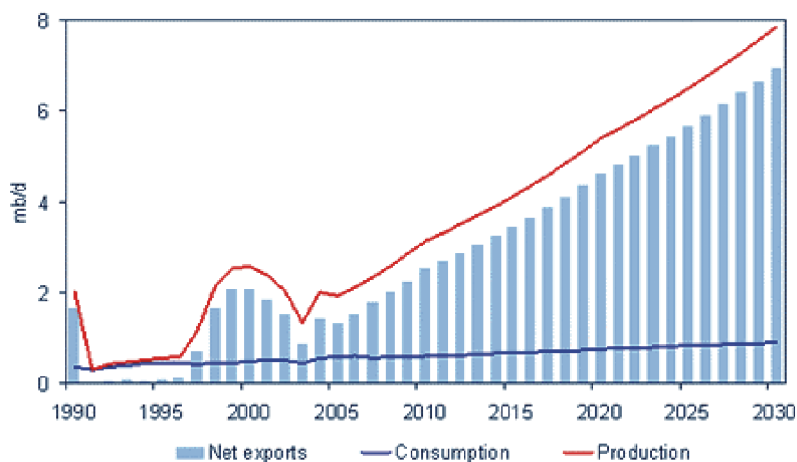
⁴⁹ See embedded spreadsheet in Paul McIntyre 'Security of Supply' (DTI Stakeholder Seminar). Downloadable from <http://www.dti.gov.uk/energy/review/seminars/page25171.html>.

⁵⁰ For chart of increasing global demand see *TEC*, p. 79 originally sourced from the IEA's *World Energy Outlook 2005* (reproduced here as 'Global Energy demand to 2030, by Fuel'.

⁵¹ <http://www.pfcenergy.com/>.

⁵² PFC Energy, 'PFC Energy's Global Crude Oil and Natural Gas Liquids Supply Forecast', 8 Sept. 2004, Presentation to the Centre for Strategic and International Studies. Downloadable from http://www.csis.org/media/csis/events/040908_pfcpresentation.pdf.

Only OPEC, in this view, can supply the deficit. This would entail remarkable increases not only in the output of relatively stable producers, but also dramatic recovery in areas such as Iraq. The IEA in its special report of October 2005, *Middle East and North Africa Insights*, sketches the way in which this might happen:



22. Iraq's Oil Balance in the Reference Scenario.

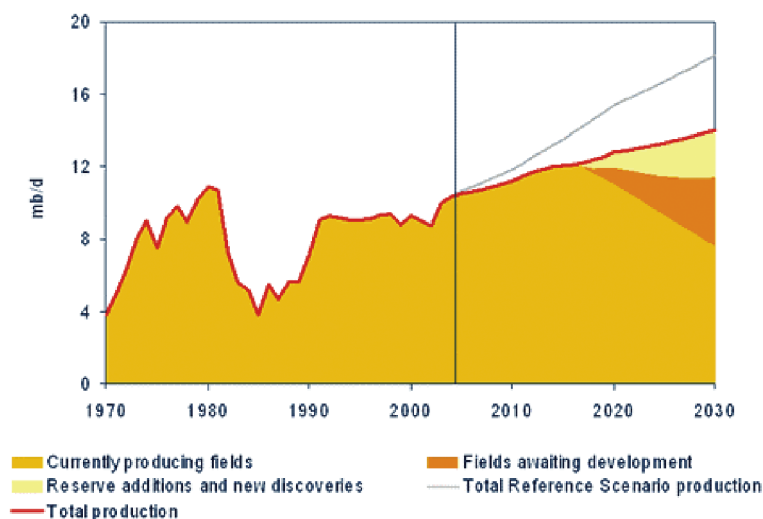
Source: IEA.⁵³

It seems probable that the UK Government has to some degree banked on a smooth growth in Iraqi production for the next quarter of a century, with significant gains in the next five years, a fact which raises many questions of profound importance. *TEC* touches on none of them.

Within OPEC, only Saudi Arabia claims the ability to raise its production significantly. In spite of this bravura, influential and eminent experts doubt that the Saudis will, in fact and with the best will in the world, be able to maintain as much as 15 million b/d for any length of time.⁵⁴ For a snapshot of the scale of the problem we can refer again to the IEA's study, and the following chart:

⁵³ IEA, *World Energy Outlook 2005: Middle East and North Africa Insights* (2005). Of this chart the IEA writes: "Iraq's oil exports are set to grow from 1.4mb/d in 2004, to 2.5 mb/d in 2010, and reach 6.9 mb/d in 2030."

⁵⁴ The latest presentation by Matthew Simmons, an investment banker and advisor to President Bush, to the US Dept of Defense on 20 June 2006 anticipates that by 2010 Saudi Arabian oil production will actually fall. Material presented by Mr Simmons can be freely downloaded at <http://www.simmonsco-intl.com/research.aspx?Type=msspeeches> Saudi Arabia is currently producing between 9 and its peak current capacity of 10.5 million b/d.



23. Saudi Crude Oil and Natural Gas Liquids in the Deferred Investment Scenario.

Source: IEA.⁵⁵

In summary, it would be prudent for the UK Government to plan on the assumption that Saudi Arabia (oil), Qatar (gas), and Russia (oil and gas) may soon all wish to cap production for pragmatic and laudable conservation-related reasons. Indeed views such as this are already gaining popularity amongst educated Saudis, who reason that the Gulf area must diversify its economic base, and the necessary capital will be plentiful provided that OPEC restrains oil production. Many educated Gulf state citizens share wider concerns over the possibility of an early peak in production and the lack of any obvious energy resource to replace hydrocarbons.

The production of oil from the massive reserves of tar and bitumen in Canada and Venezuela may assist in buffering the impact of declining or constrained OPEC output, but these have proved to be much more expensive, both in capital and energy, than had been predicted.⁵⁶ Furthermore, the CO₂ emissions arising from such production are large, amounting to between 80 and 160 kg of CO₂ for each barrel of oil produced.⁵⁷ Last year, after many years of development, Canada raised the production rate from its tar sands to one million barrels per day⁵⁸ and so emitted somewhere between 30 and 60 million tonnes of CO₂. Optimists believe that these tar sands can deliver 2 million b/d by 2015, an addition to world oil supply which would be welcome, but might also make it exceptionally

⁵⁵ IEA, *World Energy Outlook 2005: Middle East and North Africa Insights* (2005). Of this chart the IEA writes: "Saudi oil production reaches 18.2 mb/d in 2030 in the Reference Scenario, but only 14.1 mb/d in the Deferred Investment Scenario."

⁵⁶ The rapidly escalating capital cost of developing the tar sands is widely reported in the specialist journals. A July 2007 report at http://www.canadianminingjournal.com/issues/PrinterFriendly.asp?story_id=&id=58119&RTtype=&PC=&issue=07162006 reports a Shell development where the foreseen capital cost has risen nearly 100% since 2004.

⁵⁷ Francois Cupcic, presentation, Total Oil, 2003.

⁵⁸ World production was 84 million b/d. Tar sands and bitumen have a lot of 'catching up' to do!

difficult for Canada to deliver on its Kyoto commitments. Overall it is difficult to avoid the conclusion that the global economy is content to embrace Canadian and Venezuelan heavy oil production as a means to offset declines elsewhere, while giving little thought to the impact on world emissions.

The global conundrum for oil production mirrors the European conundrum over gas supply. As global demand increases and non-OPEC oil production declines, can non-conventional alternatives be brought into production quickly enough to fill the gap? The United Kingdom's vulnerability in this regard is by no means unique, but the reversal of fortunes, and the lack of contemporary planning, seems likely to increase the impact. At present the UK is well served by a mature and sophisticated petroleum sector operating globally, but in the light of rapidly declining production of oil and gas in the North Sea it will have to compete, for the first time in some decades, with more experienced importing consumers. The success of such attempts will depend on its willingness and ability to pay and the political pressure it can apply. Whereas the Governments of India and China are showing signs of understanding that there are impending supply constraints, the UK Government appears to be untroubled. We trust that this is not actually the case, but would welcome some outward indication of concern and determination to act.

Nowhere would such signs be more appropriate than in regard to the possibility of global oil capacity erosion, and the topic which is being widely debated and actively considered in the USA, in stark contrast to the dilatory discussion amongst United Kingdom decision makers. The serious nature of US Governmental engagement can be gauged from the fact that Robert Hirsch's much-discussed study, 'Peaking of World Oil Production: Impacts, Mitigation, and Risk Management', was commissioned and published by the U.S. Department of Energy's National Energy Technology Laboratory.⁵⁹ Dr Hirsch and his colleagues wisely distance themselves from any particular date for peak oil but describe in considerable detail the consequences of a failure to plan for this eventuality.⁶⁰ Conversely, they show, convincingly in our view, that early planning can mitigate deleterious consequences.

Further indications of concern amongst US strategists can be found in the Department of Defense request for a formal presentation from Matthew R. Simmons, the distinguished and highly successful Houston-based, energy investment banker. Simmons' best-selling *Twilight in the Desert* has popularised the view that, contrary to the expectations of the IEA, Saudi Arabia will be unable to increase oil production to 15 million barrels per day by 2015, and that for geological reasons alone Saudi production will fall.⁶¹ The international oil company Chevron is also prominent in expressing its concerns, and remarks on its web site:

⁵⁹ <http://www.netl.doe.gov/>

⁶⁰ The report is long and technical. But an excellent summary can be read at:
<http://www.issues.org/21.3/hirsch.html>.

⁶¹ Matthew R. Simmons, *Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy* (John Wiley & Sons: Hoboken, 2005).

*Many of the world's oil and gas fields are maturing. And new energy discoveries are mainly occurring in places where resources are difficult to extract - physically, technically, economically, and politically. When growing demand meets tighter supplies, the result is more competition for the same resources.*⁶²

Chevron's view, repeatedly expressed, is that there is a significant risk that world demand will not be fully supplied and some consumers will fail to gain access to the hydrocarbons their economies require.⁶³

Even a cursory survey of the professional literature, therefore, will show that the prospect of constrained supplies of oil and gas is now widely discussed. However, nowhere in *TEC* is this sobering and relevant scenario even mentioned. Failure to acknowledge the capacity erosion debate must be regarded as puzzling, even if it is concluded that there is a lower risk in the short and medium term than some analysts predict. The informed reader is left with the worrying suspicion that scenarios from the bleaker end of the spectrum, and not the least probable of them, have simply been ignored.

3.4.4.2: Enhanced Oil Recovery

In view of the concerns outlined above the dilatory attitude to Enhanced Oil Recovery (EOR) in the North Sea is unforgivable. The DTI has been working on using CO₂ for EOR since the early 1990s, and has produced research estimating the quantities of incremental oil that can be obtained using this technique. During the last five years DTI has sponsored fact-finding trips to the working operations in Canada and the USA, which have thirty years of practical experience. Its own Improved Oil Recovery web site has a history of distinguished papers on the subject and the Government is vocal in supporting its use internationally.⁶⁴ In the light of all this, *TEC's* five page policy statement on Carbon Capture and Storage (CCS), and the offer of £10 million to fund a demonstration project is extremely disappointing and may amount to damning with faint praise.⁶⁵ We expand on these concerns in the following section on coal.

3.4.5: Coal

The Renewable Energy Foundation agrees with *TEC* that our economic infrastructure will continue to depend on large quantities of gas and oil, especially in the short term, and we have further shown that it is neither irrational nor alarmist to suggest that the UK's security of access to these fuels is likely to be constrained by both geological and political realities in the medium term and perhaps sooner, resulting in price shock. Consequently, we believe that Government should do all it can to reduce the risks of the UK becoming a victim of events and circumstances beyond its control.

⁶² <http://www.chevron.com/about/real%5Fissues.asp>.

⁶³ Chevron also sponsors and maintains the extraordinary web site www.willyoujoinus.com that attempts to popularize the dissemination and discussion of important energy issues.

⁶⁴ <http://ior.rml.co.uk>.

⁶⁵ *TEC*, pp. 108-112.

Renewable energy will have a significant role to play in this strategy, but the heavy lifting will necessarily have to be undertaken by the conventional sector, and principally by coal. As we have argued above, it is by no means paradoxical to argue that the future of renewable energy is as dependent on the successful implementation of a long term conventional energy sector as any other aspect of our society. Only a healthy economy will be able to innovate and refine renewable technologies, and ultimately afford their gradual adoption in meaningful quantities.

It is the opinion of the UK's own Clean Coal Task Group, reporting to the DTI in June 2006, that the UK possesses one billion tonnes of mineable coal, and the following table from the US Department of Energy indicates the extent of reserves globally:

Table 1: World Recoverable Coal Reserves (Billion Short Tons)⁶⁶

Region/Country	Bituminous and Anthracite	Sub-bituminous	Lignite	Total
World Total	530.4	297.0	173.4	1000.8
United States	125.4	109.3	36.0	270.7
Russia	54.1	107.4	11.5	173
China	68.6	37.1	20.5	126.2
India	99.3	0.0	2.6	101.9
Other Non-OECD Europe and Eurasia	50.1	18.7	31.3	100.1
Australia and New Zealand	42.6	2.7	41.9	87.2
Africa	55.3	0.2	^b	55.5
OECD Europe	19.5	5.0	18.8	
Other Non-OECD Asia	1.4	2.0	8.1	11.5
Brazil	0.0	11.1	0.0	11.1
Other Central and South America	8.5	2.2	0.1	10.8
Canada	3.8	1.0	2.5	7.3
Other ^a	1.8	0.4	0.1	2.3
^a Includes Mexico, Middle East, Japan, and South Korea ^b Less than 0.05 billion short tons Note: Data for the United States represent recoverable coal estimates as of January 1, 2004. Data for other countries are as of January 1, 2003. Sources: United States: Energy Information Administration, unpublished information from the Coal Reserves Database (August 2004).				

In view of this, and the need for a rich and technologically flexible society to support long term innovation in the energy sector, not least in renewables, **the Renewable Energy**

⁶⁶ DOE Report DOE/EIA-0484(2006). Released June 2006.

Foundation fully endorses the use of coal for electricity generation, provided that the emissions are captured and sequestered. This has long been our position, and in this document we add the suggestion that the UK would do well to use coal to produce liquid fuels, provided that the considerable CO₂ emissions can be sequestered.

3.4.5.1: Coal to Liquids

There are three main routes from coal to liquid fuels, i) pyrolysis, ii) direct liquefaction, and iii) indirect liquefaction. Most analysts would now agree that the most promising route is gasification followed by a Fischer-Tropsch indirect liquefaction process.⁶⁷ This technique was developed in Germany during the 1920s to address the need to produce liquid and gaseous fuels from Germany's large coal resources. The process splits complex hydrocarbons into hydrogen and carbon monoxide and then synthesizes high value transport and basic hydrocarbons over catalysts. Hydrogen and carbon monoxide is formed when coal is gasified in the presence of pure oxygen. Such gasification plants are widely used all over the world and the process is well understood in the UK where much of the world's expertise exists.

By the end of the Second World War, Germany was producing 124,000 barrels per day from twenty-five plants. The oil import embargoes imposed upon South Africa during the 1970s and 1980s resulted in South Africa developing a significant Fischer-Tropsch coal to liquids (CTL) industry that makes SASOL, its national oil company, a world leader in this technology today. Most of South Africa's diesel fuel comes from this process, and following this lead China is now aggressively pursuing the construction of CTL plants with SASOL and Shell as partners.

In passing it should be noted that it is a variant of CTL, using Fischer-Tropsch techniques, which underlies the development of the new gas to liquids (GTL) industry. Qatar is currently developing capacity that will see this small gas-rich state producing 500,000 barrels per day of high value hydrocarbon liquids by 2015. The first plant, a joint venture between SASOL and Qatar Petroleum was commissioned during the summer of 2006,⁶⁸ and an agreement was signed between Qatar Petroleum and Shell in July 2006.⁶⁹ As touched on above, the development of high value added businesses such as GTL and petrochemical expansions bring into question the aspirations of OECD and Asian consumers of natural gas for further expansion, beyond the 70 million tonnes per year already committed.

We regard it as axiomatic that the UK, still a world centre for oil refining and petrochemical production, must develop its own Fischer-Tropsch industries as rapidly as possible. It is generally agreed that the point at which Fischer-Tropsch becomes economic against conventional oil is when the floor price of crude oil reaches \$35 per

⁶⁷ Bruce G. Miller, *Coal Energy Systems* (Elsevier: Amsterdam, 2005), 458.

⁶⁸ <http://www.qp.com.qa/qp.nsf/d26a721eee40b5ae4325711500187333/4cebdaa21d0dc4264325718600180400?OpenDocument>

⁶⁹ <http://www.qp.com.qa/qp.nsf/d26a721eee40b5ae4325711500187333/764c69f75bf2e98e432571b80033eccc?OpenDocument>

barrel. Even the ever optimistic Chairman of BP, John Browne, does not believe that the price of crude oil will decline below \$40/b, so Fischer-Tropsch appears to be currently economic. In this context the use of coal to generate liquid fuel seems prudent, not least because *TEC's* declaration of Government's intent to apply bilateral and multi-lateral diplomacy to protect the UK's position on energy supplies looks less substantial with each passing day.

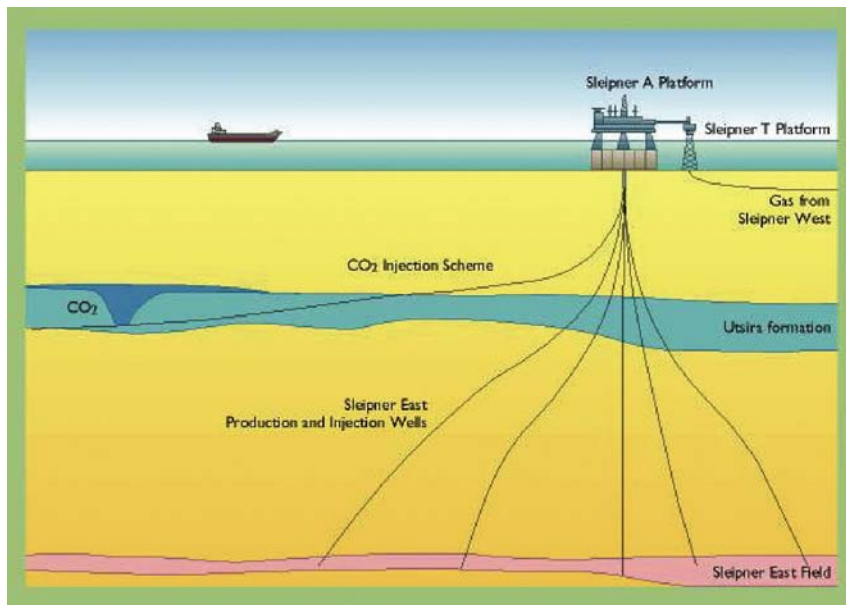
3.4.5.2: Carbon Capture and Sequestration

Of course, the Fischer-Tropsch processes are extremely energy intensive, and much of the carbon used to synthesize useful liquids will be emitted as CO₂. In both the gasification process to produce hydrogen, and the various synthesis processes, the CO₂ can be captured cheaply. Indeed, synthesis can be configured so as to minimize the cost of carbon capture, and one of the largest GTL plants being built in Qatar is being designed with carbon capture in mind.

To prevent the CO₂ being emitted to the atmosphere the gas must be gathered, compressed, and sequestered geologically. In the UK we are fortunate to be bordered by mature oil and gas reservoirs from East Anglia to the north east of the Shetland Islands. Many of these are available for sequestration, or will be soon. These reservoirs have been gas tight for millions of years and in several cases have held a high fraction of CO₂. For example, the Miller oil and gas field produced associated gas containing 25% CO₂, and the Brae area fields contain a high fraction of CO₂ which must be removed and vented at the St Fergus treatment complex before the natural gas can enter the commercial market.

Alternative solutions to venting associated CO₂ are desirable and already in operation in Norway. The gas at Statoil's Sleipner field, quite close to Miller and Brae, contains 10% CO₂. Rather than pipe such gas to Norway, where the contaminants would have to be removed and probably vented, the Norwegians devised the ingenious solution of stripping the CO₂ out at their offshore facility and injecting it into the Utsira saline aquifer, which is about 800m below the sea bed but overlies the gas reservoir. The impermeable cap rocks will ensure that the CO₂ is held permanently.⁷⁰ The process is summarised in the following diagram.

⁷⁰ Accessible descriptions of the Sleipner project can be found at <http://www.statoil.com/STATOILCOM/SVG00990.nsf/web/sleipneren?opendocument> and <http://www.iku.sintef.no/projects/IK23430000/>. The following image is from: http://www.apcrc.com.au/Programs/Geodisc_Sleipner.htm



24. Schematic Representation of the Sleipner Sequestration Process.

Source: Open University.⁷¹

These examples illustrate that by nature oil and gas fields are gas tight and as often as not are impermeable to CO₂. Indeed, it seems fair to conclude that mature oil and gas reservoirs are the safest and most economic geological structures into which CO₂ could be injected.

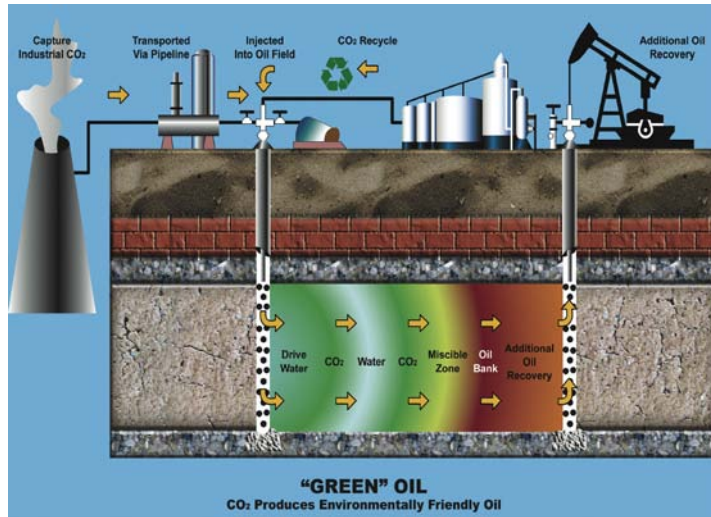
Fortunately, CO₂ has useful properties at high pressure. All oil fields and most natural gas fields are in deep locations where the pressure is proportional to the 2,000 meters or more of overlying rock and liquid. Under these conditions CO₂ becomes supercritical and liquid in form and is a powerful solvent for oily materials, such as crude oil.

The utility of these properties becomes apparent if we consider the typical life-cycle of an oil well. When the drill first penetrates the resource bearing strata the oil will readily flow to the surface, and as the pressure around the drill falls oil will flow unaided toward the well. This is referred to as the primary phase of production. Of course, when the pressure of the whole oil field has been reduced the rate of primary production falls and it becomes necessary to stimulate further movement. By pumping water under pressure into the rocks – the water flood phase – a further flow of oil can be produced, and most oilfields in the world are now in this secondary production phase. Unsurprisingly the product of this technique is a mixture of oil and water, and separation is costly. As production continues the proportion of water in the output, the water cut, increases and the energy costs of centrifuging becomes increasingly significant. At some point, the overall energy costs of production will exceed the energy value of the extracted crude oil, and the production is stopped and the well is 'shut in'. Most often, more than 50% of the original oil in the reservoir is left in place, often in the form of a film of oil around the

⁷¹ http://www.open.ac.uk/T206/illustrations/figure1_54.htm

grains of sand or limestone of which the reservoir is composed. However, liquid or super-critical CO₂ can be used to flood the reservoir when the water cut reaches unacceptable levels. The remarkable properties of supercritical CO₂ liberate the oil that the water flood was unable to move, reduce its viscosity and allow the oil to flow towards the well.

The following illustration shows a typical enhanced oil recovery (EOR) operation using CO₂ in what is called a Water Alternating Gas (WAG) flood. The CO₂ is injected and floods the target area of the reservoir. Water is then used to drive the loosened oil and CO₂ towards the producing well.



25. Schematic Representation of Carbon-dioxide sequestration for Enhanced Oil Recovery.

The mixture of oil, water-associated hydrocarbon gas, and CO₂ is then treated at the wellhead. Firstly, the gases are separated from the liquids, and the oil from the water. The gas unit then removes the CO₂ which is compressed and re-injected.

Eventually, CO₂ fills most of the space left by the removed oil and the proportion of oil declines. When the returned oil is no longer economic in quantity the 'tertiary' phase of production ends and the well is shut in. An industry rule of thumb suggests that over the lifetime of the CO₂ flood, one tonne of CO₂ buried will produce about 3 barrels of incremental oil. In the USA the technique has been practised for thirty years, mainly in the Permian Basin of West Texas, and over 200,000 barrels of CO₂-incremental oil are produced daily. The following map indicates the geographical scale of these activities.



26. Network serving CO₂ for Enhanced Oil Recovery in the Permian Basin.
Source: Kinder Morgan CO₂ Company.

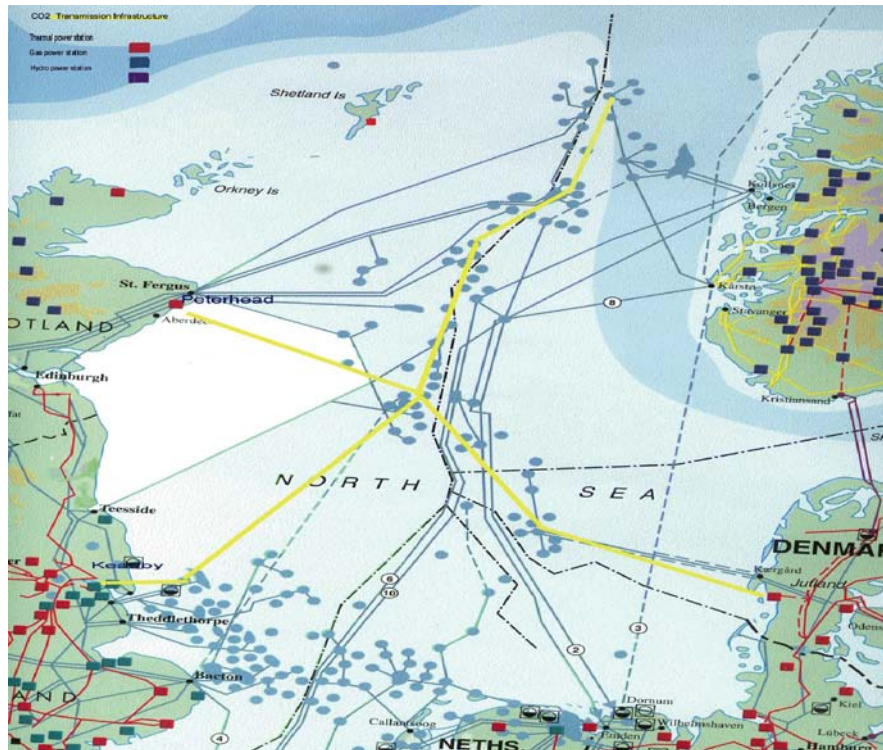
There are currently over seventy such WAG floods and more are being initiated. The USA rightly foresees that if it is ever to join the Kyoto signatories in attempting to reduce greenhouse gas emissions on a meaningful scale, it will mostly have to rely on sequestering CO₂ from super-efficient power stations.⁷²

The North Sea reservoirs have been extensively studied for EOR using CO₂ and there is wide agreement amongst the oil companies as well as the regulatory bodies that these areas are quite as suitable for CO₂ injection and oil recovery as those in Texas. In fact, in 2002, a major development effort was made by the Danish utility, ELSAM⁷³ and the Houston-based Kinder Morgan CO₂ Company,⁷⁴ to kick-start the construction of a similar, North Sea-wide effort in Europe. The sponsors named this project the CO₂ for EOR in the North Sea (or CENS) Project.

⁷² <http://www.fe.doe.gov/programs/sequestration/cslf/>

⁷³ <http://www.elsam.com/index.dsp?area=1004>

⁷⁴ <http://www.kindermorgan.com/business/co2/>



27. Proposed CO₂ for EOR in the North Sea.
Source: Russel Martin, KM CO₂.

As can be seen in the map above, CO₂ would have been sourced from power stations and factories from all over north west Europe and used for EOR at oil fields around the UK, Norwegian and Danish median lines.⁷⁵ A great deal of interest was shown, but the project failed to progress when the DTI announced in May 2003 that it had studied the project and concluded it could not be economic at \$16 per barrel, that being the price of the CO₂-incremental barrel they had discussed with the oil companies. In retrospect, with oil now at around \$70 a barrel, this misjudgment seems unfortunate for all concerned. If the CENS project could be re-launched today, the economics, which were good at \$25 per barrel, would be highly attractive. It is therefore particularly disappointing that the DTI continues to treat EOR and carbon capture and storage as if they were unknown quantities. *TEC's* proposal for a £10 million commercial demonstration will add little or nothing to what is already known, and will in all probability only cause further delays to the development of full-scale CCS, thus losing valuable oil and gas production and the chance to make realistic and internationally compelling reductions in UK CO₂ emissions.

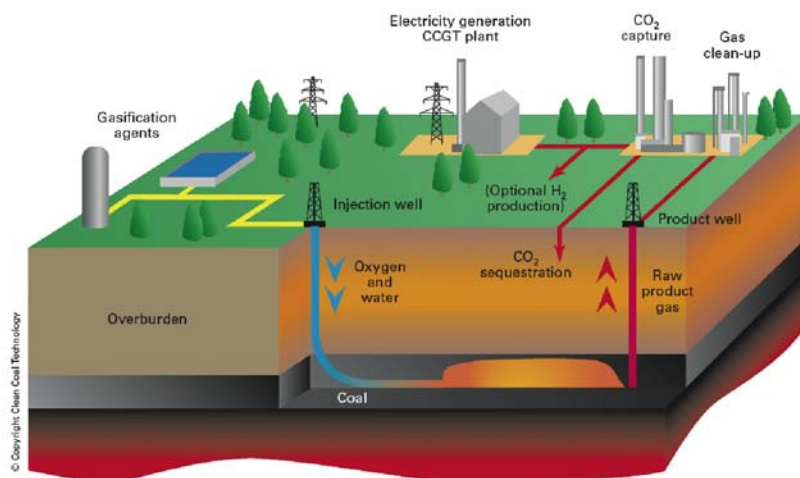
Power production using clean coal technologies and the launch of a Fischer-Tropsch industry in the UK are urgent. It would be prudent to take action in this area immediately, before the global geopolitics of energy and the realities of oil production take any critical turn for the worse. As we have observed several times above, it is difficult to see how

⁷⁵ The report can be found at the DTI's 'improved oil recovery' web site: <http://ior.rml.co.uk/issue4/co2/inco2/summary.htm>

renewable energy can progress if the United Kingdom experiences a crisis in the provision of economic fuel for transport and electricity generation.

3.4.5.3: Non-conventional coal extraction

Much of the coal resource under UK sovereign control is not accessible to conventional mining techniques. We therefore endorse the environmentally judicious application of non-conventional techniques such as Underground Coal Gasification (UCG), which gasifies coal within the underground seam by the injection of an oxygen-water mixture to produce a syngas⁷⁶ of medium calorific value suitable for power generation in a combined cycle turbine, industrial heating or the manufacture of hydrogen, methanol, or diesel fuel.



28. Schematic Representation of UCG for Electricity Generation.⁷⁷

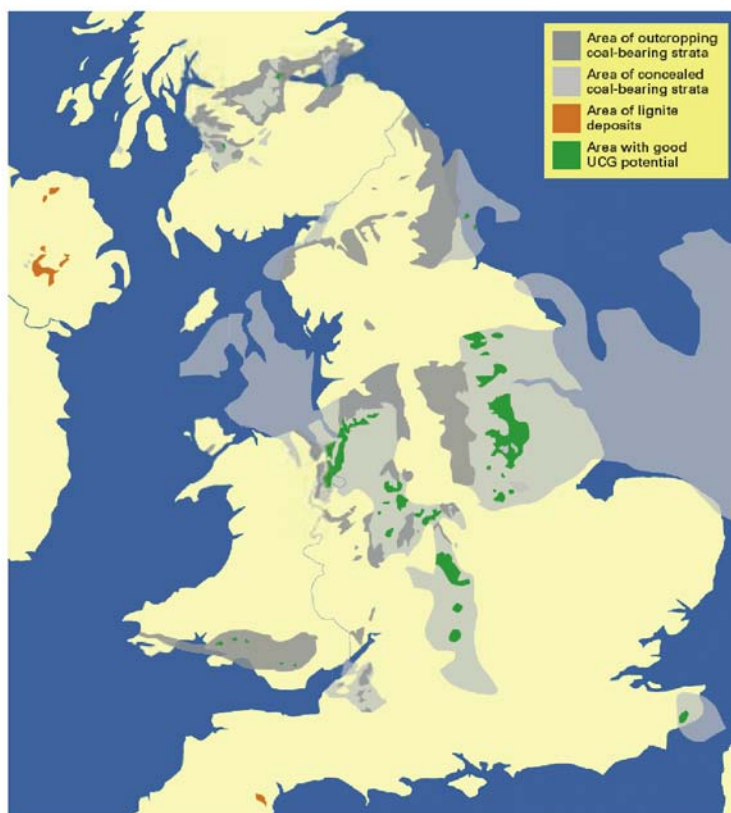
In addition, the process creates large porous voids underground. Under the right geological conditions, and deep underground, these spaces may be suitable for the sequestration of CO₂.

UCG is well covered at other locations,⁷⁸ and we will refrain from further comment, but it is perhaps worth pointing out that in addition to the substantial onshore coal resource in the UK, there are very large deposits offshore, as is well known from the experience of the oil and gas industry. Many are readily accessible from shoreline, for example off the coasts of Northumberland, Lincolnshire, Norfolk, Kent, South Wales and the Firth of Forth in Scotland, which has already been the subject of a UCG feasibility study. The scale of these resources is little appreciated by the general public, and it is worthwhile to reproduce the following DTI map to bring this point home.

⁷⁶ A gas consisting mainly of carbon monoxide and hydrogen, and produced during the steam reformation of liquid hydrocarbons, coal, and natural gas.

⁷⁷ See DTI, *Review of the Feasibility of Underground Coal Gasification in the UK* (2004) p. 9.

⁷⁸ See for example the UCG Partnership site: <http://www.ucgp.com/>, and the remarks of the Coal Authority: <http://www.coal.gov.uk/resources/cleanercoaltechnologies/ucgoverview.cfm>.



29. Principal Resources for UK UCG.

Source: DTI.⁷⁹

While onshore, and shore-line accessed resources could provide a gas supply for very long periods, perhaps centuries, platform-based projects in deep water could in principle extend this still further. In view of the difficulties facing the United Kingdom in the medium term this energy potential will very probably have to be accessed for both gas and possibly CO₂ storage, and the omission of any discussion in *TEC* is regrettable.

3.4.5.4: Coal: Conclusion

The United Kingdom's Industrial Revolution was supported by coal and the world still possesses large mineable resources. It is far from outlandish to suggest that the remaining reserves could and should support further technological innovation, not least in the renewable sector, to support the UK and its people in the medium and longer term. The short section treating coal in *TEC* is highly unsatisfactory, and we judge it to be inferior to the Clean Coal Task Group's 'A Framework for Clean Coal', which was commissioned by the Government in May this year. In this report we read:

The UK itself possesses substantial coal reserves, about 1 billion tonnes of which are potentially economically extractable. If international coal prices remain relatively high, then this figure could increase further. Indigenous coal is free of

⁷⁹ DTI, *Review of the Feasibility of Underground Coal Gasification in the UK* (2004) p. 8.

*the volatility associated with international coal prices, exchange rates and shipping rates and reduces strains on a congested port and railway infrastructure.*⁸⁰

This is true, and, as we have shown above, the potential for coal in many other areas around the world is very considerable. At a time when the UK is at risk of, and is to some already experiencing, resource constraint and price shock in regard to both oil and gas the pursuit of alternative energy sources is of great importance. Renewables and the proposed nuclear rebuild can both contribute to mitigating risk, one very modestly, the other on a significant scale but only in the medium term. Coal, on the other hand, can contribute on the large scale and within the requisite timeframe. It is essential therefore that the government addresses *TEC's* neglect of coal in the forthcoming White paper, and we urge the use of coal fuelled electricity generation of the highest efficiencies with carbon capture and sequestration, and the use of coal to produce liquid fuels. **The alternative energy revolution, from fusion to renewables, will be built with wealth from coal, oil, and gas, or it will not be built at all.**

3.5: Electricity Generation

TEC states:⁸¹

Summary of Proposals relating to Electricity Generation

Government will:

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

Measures on Renewable Energy

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

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

⁸⁰ Clean Coal Task Group, 'A Framework for Clean Coal in Britain' (June 2006). Available from <http://www.tuc.org.uk/extras/coal.doc>, and <http://www.coalpro.co.uk/A%20Framework%20for%20Clean%20Coal.pdf>.

⁸¹ *TEC*, pp. 97, 106, 112, 124.

This will include:

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

Next Steps on CCS

The Carbon Abatement Technology demonstration programme will formally launch its first call for proposals in September 2006, with a first call worth £10 million which will focus on the pre-commercial demonstration of key components and systems to support carbon abatement technologies.

- *The Government will continue to work with international partners to amend international legal frameworks to provide the legal basis for CCS.*
- *The work of the CCS Regulatory Task Force will continue in consultation with industry and other stakeholders in order to clarify and develop proposals on appropriate regulations both to facilitate CCS and to ensure the environmental integrity of CCS activities.*
- *The Government will continue working with international partners to develop CCS's potential, including through the recently announced joint United Kingdom-Norway project on enabling CCS in the North Sea and the EU-China Near-Zero Emissions Coal initiative.*
- *The Government will continue to push for the recognition of CCS within the EU ETS.*
- *The Government believes that the next stage would be a commercial demonstration of CCS, if it proved to be cost-effective. More work on the costs of such demonstration projects will be undertaken, and a further statement will be made at the Pre-Budget Report.*

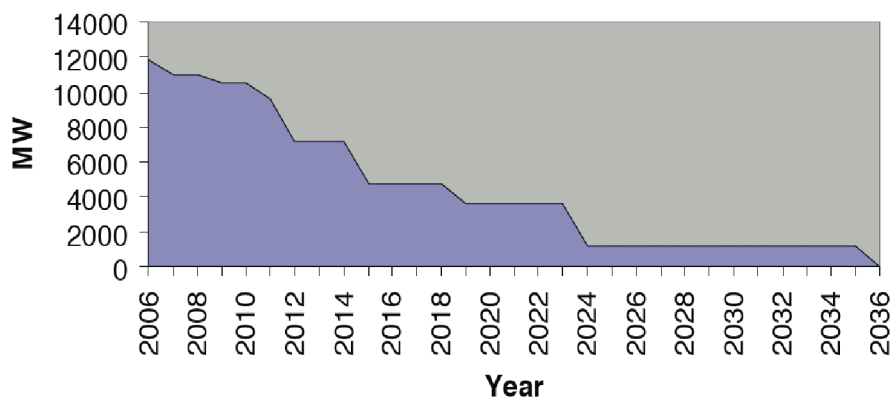
Nuclear Proposals

- *The Government believes that nuclear has a role to play in the future United Kingdom generating mix alongside other low carbon generation options.*

- *Any new nuclear power station would be proposed, developed, constructed and operated by the private sector who would also meet decommissioning and their full share of long-term waste management costs.*
- *We will undertake further assessment which will help developers in identifying the most suitable sites. It will be up to the potential participants of new build to discuss with the owners appropriate access to suitable sites. Government will monitor whether an appropriate market in suitable sites is developing.*
- *Government has asked HSE to take forward proposals to introduce a pre-licensing, design authorisation procedure, and the Environment Agency to introduce a similar system of pre-authorisation.*
- *Government is setting out a proposed framework for the consideration of the issues relevant to new nuclear build and the context in which planning inquiries should be held. This framework would be set out in a White Paper to be published around the turn of the year. To support preparation of this White Paper, Government is consulting on the proposals outlined in annex A of this publication.*
- *We are seeking views on a policy framework in which national strategic and regulatory issues are most appropriately discussed through processes other than the public inquiry. The inquiry should focus on the relationship between the proposal, the local plans and local environmental impacts. The inquiry should weigh up these issues against the national strategic or regulatory material considerations, which will have already been established. The inquiry should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.*
- *As is proposed for the more contentious onshore wind projects, Government will appoint a high-powered inspector whose role will be to ensure that planning inquiries are run to clearly defined timescales, and maximum use is made of the powers and efficiencies set out in the major infrastructure projects rules.*
- *Government will engage with industry and other experts to develop arrangements for managing the costs of decommissioning and long term waste management based on the principles set out in this text.*
- *Government intends to appoint an individual with senior management or financial experience of major capital investment projects to lead the development of arrangements for the costs associated with new build decommissioning and waste management. This individual, who will be supported by officials from the DTI, will lead discussions with industry on these topics and make proposals, based on the principles set out below. Further details on the work programme and timetable will be published by the time of the White Paper.*

3.5.1: The Capacity Crunch

TEC acknowledges that 25 GW of thermal power generation must be retired and replaced 'within the next two decades'.⁸² However, this form of words gives the false impression of a somewhat leisurely rate of decrease. In fact the decline in the short to medium term is abrupt, as can be gauged from one of the DTI's own charts, not included in *TEC*:⁸³



30. Current Expected Decline in Nuclear Capacity in UK Generation.
Source: DTI, 2005.

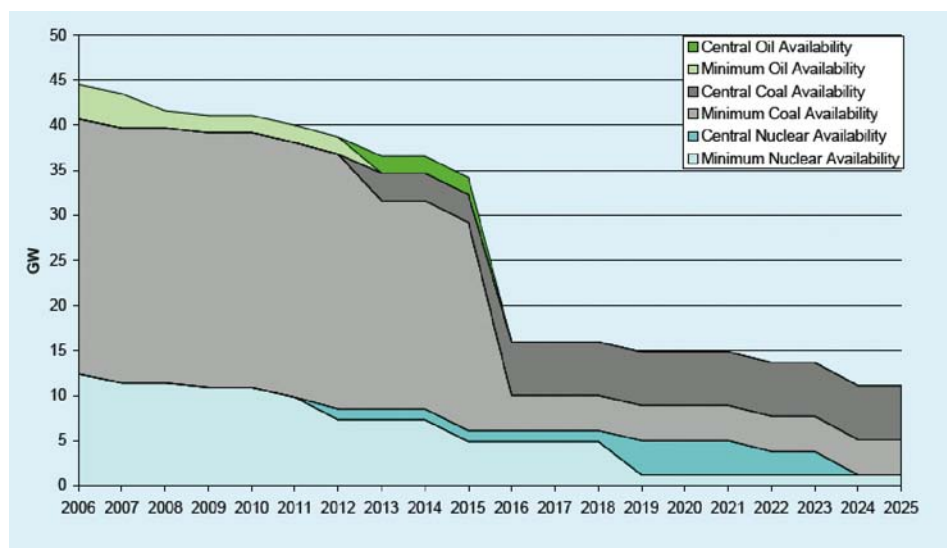
By 2015, only eight years from now, nuclear capacity will have shrunk from 12 GW to around 5 GW. Furthermore, by 2015 a combination of environmental legislation and obsolescence will probably require the retirement of upwards of 10 GW of coal capacity, and any remaining coal capacity after 2015 will be among the oldest and least efficient in Europe.⁸⁴

These prospects are well-known in the generation sector but have not yet impinged on the wider public and political consciousness, and to all appearances play a disappointingly small role in *TEC*. By way of external reference we draw attention to the chart presented by EDF in its submission to the Energy Review consultation:

⁸² 'Over the next two decades, it is likely that we will need around 25 GW of new electricity generation capacity, as power stations – principally, coal and nuclear plants – reach the end of their lives and close.' *TEC*, p. 16.

⁸³ Daron Walker (Project Director, Energy Review Team) 'The 2006 Energy Review Regional Stakeholder Seminar: Nuclear Regulation (Stakeholder seminar, 9 March 2006)', slide 8. Available online from: <http://www.dti.gov.uk/energy/review/seminars/page25171.html>.

⁸⁴ Scottish & Southern Energy has recently announced plans to replace Ferrybridge Power Station but has not yet announced the proposed capacity nor a timetable for its commissioning.



31. Profile of Generation Plant Closures.

Source: EDF Energy Analysis.⁸⁵

The analysis of this scenario by EDF bears close scrutiny:

The UK is facing an electricity generation capacity shortage during the next decade as coal and oil-fired power stations close, largely in response to new environmental controls imposed by the Large Combustion Plants Directive (LCPD), and as gas cooled nuclear power stations reach the end of their useful lives.

Between now and 2016, 13GW of coal and oil plant that have 'opted out' of the LCPD will close. 'Opted in' coal plant may also be closed by 2016 depending on the economics of fitting further equipment to reduce emissions of nitrogen oxides – for which new limits are to be introduced after 2015. 7.5GW of nuclear closures are scheduled by 2015. [...]

The UK will have a generation gap of 32 GW in 2016, assuming moderate demand growth and expected growth in renewables in line with the Renewables Obligation (RO). Even under very optimistic scenarios regarding grid electricity demand reduction the generation gap will still be 25 GW in 2016.⁸⁶

So in fact, during the next nine years, the capacity shrinkage of existing plant will require a replacement of between 20 and 30 GW of secure capacity in order to contain loss of load probabilities within reasonable bounds. This is 25-40% of the UK's current generating

⁸⁵ EDF, *Energy Review Submission 2006*, p. 12. Available online from: http://www.edfenergy.com/core/energyreview/edfenergy-energy_review_response_main_document_v4-3.pdf#search=%22edf%20energy%20review%20response%22

⁸⁶ EDF, *Energy Review Submission 2006*, p. 12. Available online from: http://www.edfenergy.com/core/energyreview/edfenergy-energy_review_response_main_document_v4-3.pdf#search=%22edf%20energy%20review%20response%22

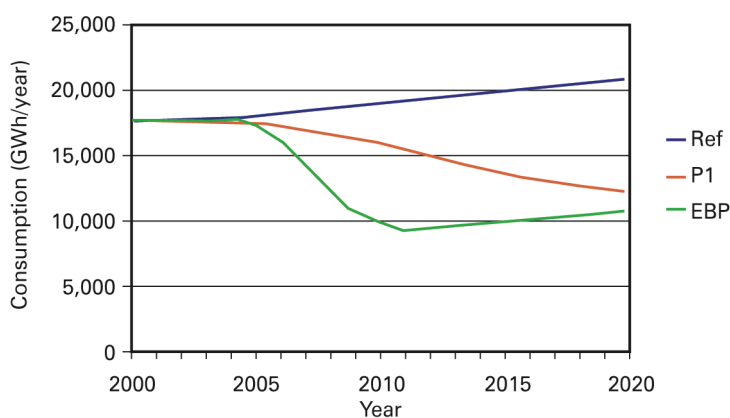
fleet of 78 GW. We emphasise that the UK has just nine years, not two decades, in which to conceive, plan, license, design, finance, procure, and build anew a large proportion of its generating capacity, and to do so in ways which are secure, reliable, clean, and do not result in undue reliance on any one fuel. While the DTI must recognize this as fact the language of *TEC* tends to obfuscate the urgency of the situation, and there is scant evidence that Government has learned from its own consultants' reports, such as the powerful study by Redpoint Energy entitled 'Dynamics of GB Electricity Generation Investment',⁸⁷ which makes it plain that the BETTA trading arrangement may need root and branch reform to encourage external investment in high capital cost equipment.

3.5.2: Energy Saving and Peak Load

The importance of energy saving has become a cliché, but it cannot be repeated too often that the cheapest electricity, and the least CO₂-emitting, is the electricity that is never generated. However, while *TEC* acknowledges the importance of conservation and demand reduction it is not always clear that this goes beyond lip-service. As an important example, we have already noted and applauded the Prime Minister's mention of low energy light bulbs in his preface. It is unsatisfactory to find that *TEC* does not follow through with the strongest possible measures to promote their much wider use in the United Kingdom. These benefits are well-known, and exist in readily understood forms in many locations. For example, the Market Transformation Programme, a body largely funded by DEFRA and devoted to supporting the Government's policy on sustainable products, provides concise briefing notes on this subject. The MTP publishes the following chart which reflects the estimated electricity consumption for domestic lighting under three scenarios.⁸⁸ The Reference Scenario represents underlying trends and currently implemented policies, the Policy Scenario P1 shows the impact of all currently proposed policy actions, and the Earliest Best Practice scenario, EBP, shows the consequence of very rapid adoption of best practice. The electrical energy which could be saved by the simple expedient of exchanging standard light bulbs with state-of-the art bulbs in *domestic* housing is a significant 0.7% of all electrical energy generated during 2005, and it is reasonable to assume that the adoption of low energy lighting in commercial and institutional environments could save still more significant quantities.

⁸⁷ Available from <http://reporting.dti.gov.uk/cgi-bin/rr.cgi/http://www.dti.gov.uk/files/file31887.pdf>, and <http://reporting.dti.gov.uk/cgi-bin/rr.cgi/http://www.dti.gov.uk/files/file31799.pdf>.

⁸⁸ Market Transformation Programme, 'UK Energy Consumption of Domestic Lighting'. See <http://www.mtprog.com/PolicyBriefs/Stage1.aspx?intPolicyBriefID=500012&strPolicyBriefTitle=UK%20Energy%20Consumption%20of%20Domestic%20Lighting&intPolicyBriefSector=4>



32. Electricity Consumption by Domestic Lighting Under Three Scenarios.

The MTP comments that ‘in principle 8.1 TWh could be saved in 2020 by a range of mainly national policy measures aimed at bringing forward efficient lamp technology’. Significant though this is the utility of low energy light is much greater than the simple *energy* savings it offers. Efficient lamp technology would bring about a reduction in *power* load that would be exceptionally valuable in the current context of a looming shortfall in dispatchable electrical power generation. Lighting is used most in the winter and most lighting is on during times of peak national load. A rough calculation suggests that the average generation capacity needed to supply the power load of domestic lighting alone is a highly significant 6,800 MW (Sizewell B is 1,200 MW in size). This is a large fraction of the nation’s power capacity, and leads us to infer that if householders could be persuaded to employ devices with lower instantaneous power demands then peak loads could be reduced by meaningful margins, thus reducing the need for the construction of firm generation. It should be noted, of course, that many commercial premises already operate with low energy lighting, but the remaining gains cannot be ignored, and similarly helpful savings can probably be achieved in the white goods business.

It is puzzling that *TEC* does not remark on this matter, and we urge the Government to recognise that the *power* rather than the *energy* perspective suggests that high efficiency lighting has value to the public interest which far exceeds its local benefits. In our view this consideration may elevate it well over other means to reducing electricity consumption, and so deserve special public support.

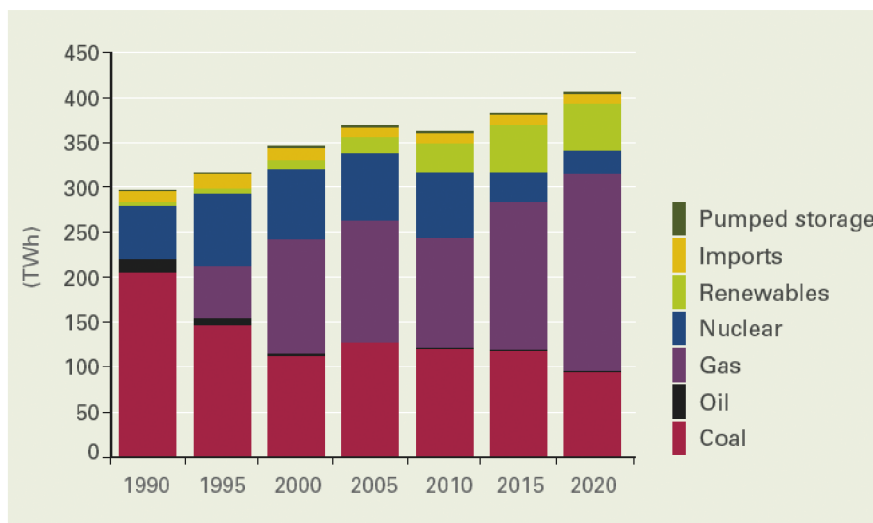
3.5.3: Diversity of the Generation Portfolio

We agree with *TEC* that in 2006:

*The UK currently benefits from a diverse electricity generation mix [...] that reduces the UK’s dependency on a single fuel type and helps maintain a secure supply of electricity.*⁸⁹

⁸⁹ *TEC*, Introduction, p. 92

We welcome the fact that Government has apparent reservations over the drift of the sector towards over-dependence upon gas, as indicated by the following chart from *TEC*:



33. Electricity Generation Mix: Projections to 2020.

Source: DTI.⁹⁰

We have already noted this trend, and attributed it to an overconfidence in the operation of the free market, as exemplified by NETA and BETTA.

We also wish to draw attention to the fact that *TEC*'s analysis of the likely run-down of firm capacity is surprisingly relaxed, and differs from that of other commentators. *TEC* states:

Around 8GW (roughly a third of current capacity) of the UK's coal power stations must close no later than 2015 as a result of EU environmental legislation.⁹¹

Yet in June, 2006 the *Clean Coal Task Group* highlighted the probability that the 11 GW of 'opted out'⁹² coal units

[...] are restricted to 20,000 hours of operation from 1 January 2008, and in any case must close by the end of 2015. The indications are that some plants will burn up their hours quickly and close early, whilst others will spread their hours thinly.⁹³

⁹⁰ *TEC*, p. 93.

⁹¹ *TEC*, p. 92.

⁹² I.e. coal-fired power plants that have elected not to install flue gas desulfurisation (FGD) as required by the EU's Large Combustion Plants Directive (LCPD).

⁹³ Clean Coal Task Group, 'A Framework for Clean Coal in Britain' (June 2006), p. 6 Available from <http://www.tuc.org.uk/extras/coal.doc>, and <http://www.coalpro.co.uk/A%20Framework%20for%20Clean%20Coal.pdf>.

Furthermore, the Task Group pointed out, which *TEC* astonishingly does not, that by 2016, all the remaining coal plants that are still in operation will be obliged by the LCPD to install supplementary equipment to reduce NO_x emissions. The probability is that the only device that can ensure NO_x reduction is Selective Catalytic Reduction (SCR). The investment in SCR is similar in scale, and could perhaps be even greater, than the investment in Flue Gas Desulphurisation (FGD). *TEC* did not go on to point out that by 2016 the newest opted in plant in the UK, Drax, will be forty-two years old. Some plant will be over fifty years old.

Indeed, it is worth recalling that Drax is the newest plant in a coal fleet that is by far the oldest and least efficient in Europe. Last year, the efficiency of this fleet averaged an unsatisfactory 35.9%.⁹⁴ Unless these plants are made carbon-capture-ready, a sink found for the CO₂, and a framework developed for its injection into geological structures, the 800 to 900 kg/MWh emitted today will have been increased by the additional inefficiency that is a consequence of FGD and SCR. Yet in view of the likely price of gas it is these plants that are likely to be the baseload of British electricity generation.

Objectively, silent acceptance of a large and inefficient fleet of coal plants is baffling at a time when the Government is reported as seriously discussing personal CO₂ quotas, and restrictions on the few remaining years of cheap air-fares. This inversion of priorities suggests a tendency towards eye-catching and controversial initiatives rather than practical and fundamental efforts to reduce emissions and maintain supplies of electricity.

The Clean Coal Task Group's *A Framework for Clean Coal* recommends that the 11 GW of 'opted out' coal-fired power plants need to be replaced with state-of-the-art, carbon-capture-ready, super-critical power plants as soon as possible. This is simple common sense and we endorse it. We would go much further and propose that the replacement of obsolete coal plants by new installations should be a high priority for the UK.⁹⁵

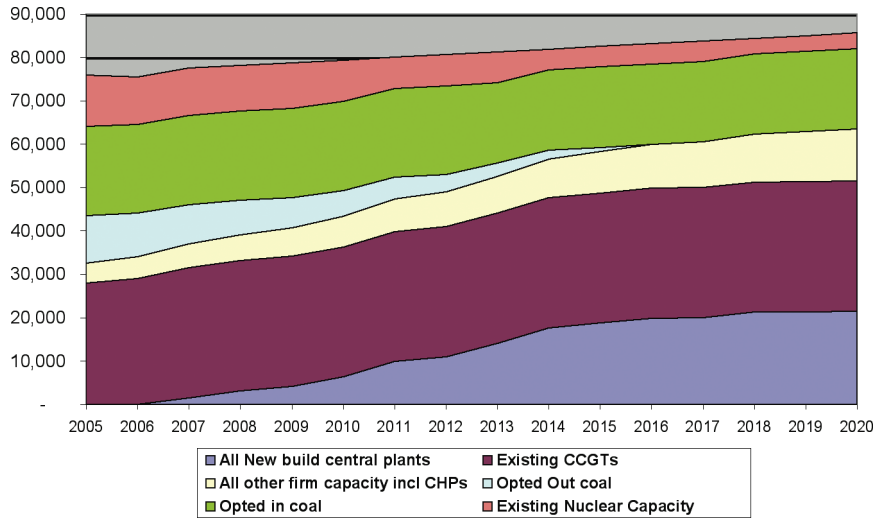
In the chart overleaf, we have assumed that peak demand will continue to increase by 500 MW per year and that the present margin of surplus capacity, roughly 25%, is maintained. We have pointed out that a mass-switch to low energy lighting and other low energy technologies, could reduce rather than increase peak loads but will assume for the purpose of this argument that *TEC* is correct.

We have also assumed that if time is allowed for the full and absolutely necessary public debate over the nuclear question then no new nuclear plant will be commissioned before 2020. We have also assumed, optimistically, that opted out coal plant will be run down at the rate of 1,000 MW per year. As noted in earlier chapters, fuel disruptions in the gas

⁹⁴ Based on the higher heating value of the coal used. This would be about 37.8% if based on the Lower Calorific value (LCV), the normal measure of efficiency assessment used in Europe. The figure is reported in the DTI's statistics for 2005.

⁹⁵ The UK-based subsidiary of Mitsui Engineering, Babcock Mitsui, is a World leader in the development of super-critical power stations and has a significant share of the Chinese market for these.

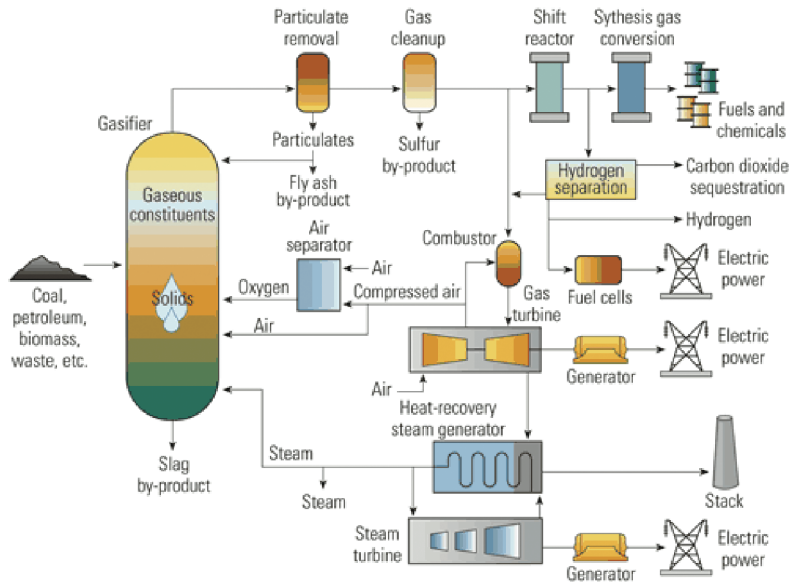
sector might well tempt Government to declare, force majeure, that such coal plant must be run for more hours than the rules require.



34. UK Generating Capacity (MW) to 2020.

In consequence we conclude that Government must consider the revision of the BETTA trading rules as a matter of extreme urgency. These revisions must recognise the importance of firm capacity of all kinds and reward accordingly those investors willing to take the risk of supplying such plant. Only then will the sensible recommendations of the Clean Coal Task Group and others become a commercial reality. It is very much to be hoped that a helpful fraction of the new build could be from firm capacity renewables, principally from various forms of tidal energy, and from biomass.

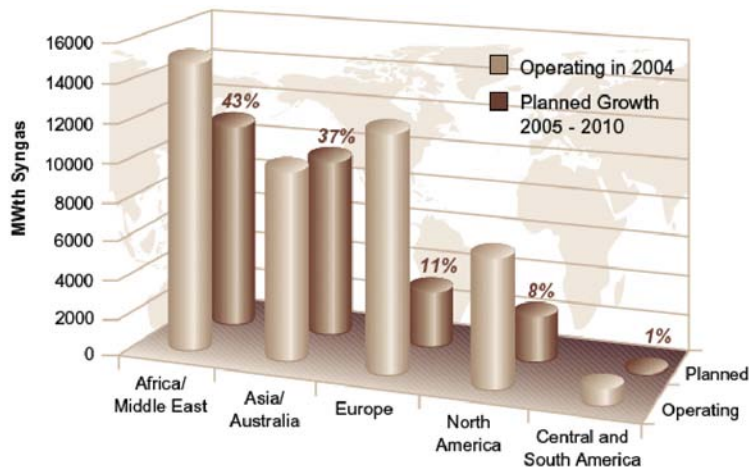
In our comments on oil and gas we have already recommended a crash-programme to develop a Fischer-Tropsch industry to lessen the UK's dependence upon imported crude oil, and it is part of this recommendation that the large quantities of CO₂ generated should be used for Enhanced Oil Recovery (EOR) from the mature reservoirs under the North Sea. We are aware of discussions that are taking place between DTI officials and power company managements concerning the repowering of existing CCGTs with coal gasifiers. In such cases the pure CO₂ that can be captured from gasification would also be destined for EOR. The configuration for new-build, carbon capture ready Integrated Gasification with Combined Cycle (IGCC) and carbon sequestration is indicated in the diagram overleaf. IGCC is the central technology being considered by the United States in the development of the 'Supergen' project intended to launch a fleet of carbon-capture and sequestration power plants throughout the USA.



35. Block/process diagram of a typical IGCC plant.

Source: WorleyParsons.⁹⁶

Gasification and its derivative, IGCC, is nothing new, and substantial quantities of plant have been in operation for some decades all over the world, as can be seen in the following chart:



36. World Gasification Capacity and Planned Growth, by Region: Share of Planned Growth in World Gasification Capacity (%).⁹⁷

⁹⁶ Available online: http://www.powermag.com/archive_article.asp?a=2j0i0z6p030x915RM0K341_1&y=2006&m=march

⁹⁷ US DoE, Office of Fossil Energy, National Energy Technology Laboratory, *Current Industry Perspective: Gasification: Robust Growth Forecast*, results of the World Gasification Survey, 2004 (Sep. 2005), p. 6. Downloadable from: <http://www.netl.doe.gov/publications/brochures/>

UK subsidiaries of US consulting companies, such as Jacobs, are engaged in the worldwide design and construction of gasification plants and power plants based upon gasification. It is puzzling that *TEC* makes no reference to the expansion of this technology.

No one should be in any doubt that coal is also a finite resource, and that conventional mining can be extremely damaging to the environment. However, we have argued that in the mid-term the Fischer-Tropsch industry and the development of a new generation of coal-based power plants are necessary to sustain a wealthy and technically self-confident United Kingdom. We estimate the value of this contribution to be sufficiently high to justify the cost of ensuring that the environmental impacts are successfully mitigated.

We have several times noted above that only a rich and scientifically sophisticated society can develop the technological innovations necessary for a significant capacity of renewable energy. Unlike so many who call themselves environmentalists, we do not believe that the development of advanced coal use, or, should this be decided upon after public debate, the development of new, safe, nuclear power stations need hold back the development of renewable energy.⁹⁸ Indeed we judge that renewable futures are critically dependent on the conventional sector. Enthusiasts for renewables, and the general public, must be brought to recognise that for the most part the sector remains in a primitive condition, and will not progress further in conditions of economic distress. The causes for this disappointing degree of improvement and deployment are manifold. While we do not deny that there are inherent difficulties in many of the renewable technologies these are not the principal delaying factor. In our view the root causes are a lack of realism with regard to displacing the conventional sector, and over-protection of the sector via subsidy and other mechanisms which have removed incentives for technological innovation. Rather than engaging in factitious opposition to conventional energy renewables must innovate and co-operate.

The pressing need for such realism can be illustrated with the example of wind energy, currently the most active and prominent of renewable energy technologies. It now seems to be more generally accepted than it was at the time of the 2003 White Paper that even a large and distributed wind carpet will not (without storage) contribute appreciably to the UK's need for firm capacity. *TEC* itself comments:

[...] the contribution of renewable generation to security of supply is potentially very different from conventional generation [...]. Although wind generation may displace energy produced by conventional plant, its ability to displace

pdfs/Gasification_Brochure.pdf#search=%22world%20gasification%20capacity%20and%20planned%20growth%22.

⁹⁸ For a representative example of this misconception see Catherine Mitchell and Bridget Woodman (Warwick Business School), 'New Nuclear Power: implications for a sustainable energy system', report for The Green Alliance (2006). Downloadable from www.green-alliance.org.uk.

*conventional network capacity is limited even at substantial penetrations, due to its variability.*⁹⁹

In doing so the DTI is implicitly recognising the experience of both Germany and Denmark, and echoing the remarks of many other experts in the field.¹⁰⁰ This acceptance is welcome and clears the way for a more rational discussion and economic evaluation of renewable generating solutions that, even if they are not constant, are sometimes like tidal, completely predictable.

However, as emphasised in our contribution to the Energy Review consultation, we are positive about offshore wind. Consultants instructed by the Renewable Energy Foundation have studied the performance of both the Danish and UK wind fleets onshore and offshore, and find that although the latter are more costly to build, they also enjoy a much higher capacity factor than most onshore wind farms. The Nysted wind farm offshore from Lolland in the Baltic and the Horns Rev wind farm in the North Sea enjoy capacity factors on a sustained basis that are over 40%. This can be compared with onshore results in southern England, which are sometimes well below 20%. For example the flagship wind turbines at Ford's Dagenham plant achieved an annual capacity factor of 19% in 2005. Another installation of equally high profile, the Renewable Energy Systems turbine at Kings Langley on the M25, seen every day by tens of thousands of motorists, achieved an annual capacity factor of 7.7%.¹⁰¹ It is highly questionable whether either can be economic or considered a wise use of scarce resources.

Dagenham and Kings Langley are particularly disappointing cases, but are of relevance precisely because of their proximity to the London load centre. Offshore sites, within a relatively close distance from the capital have the potential of achieving vastly better results. When the teething problems at offshore sites have been solved we expect that most wind farms built offshore from the UK will produce similar results to those at Nysted and Horns Rev, and we infer, therefore, that even if offshore wind does not supply firm capacity, their proposed location in the Thames Estuary, the Wash, the Humber, and offshore the industrial North West would probably be worthwhile.

⁹⁹ *TEC*, p. 209.

¹⁰⁰ Examples include: Michael Laughton, 'Power Supply Security with Intermittent Sources: Conventional Plant Capacity Requirements', *Power in Europe*, 460 (10 Oct. 2005); Dusko Nedic, Anser Shakoor, Goran Strbac, Mary Black, Jim Watson and Catherine Mitchell, *Security assessment of future UK electricity scenarios* (July 2005) Tyndall Centre for Climate Change Research Technical Report 30. Available from: http://www.tyndall.ac.uk/publications/tech_reports/tech_reports.shtml; Hugh Sharman, 'Why Wind Power Works for Denmark', *Proceedings of ICE: Civil Engineering*, 158 (May 2005), 66-72; and 'Why the UK should build no more than 10 GW of Wind Capacity', *Proceedings of the Institution of ICE: Civil Engineering* 158 (November 2005), 161-169.

¹⁰¹ Both figures computed from Renewables Obligation data publicly available on the Ofgem website: <http://www.ofgem.gov.uk/>

However, in common with most, perhaps all, high wind regimes, Danish offshore wind exhibits deep spiking, with large rises and falls in generation output over intervals as short as five minutes. So that the deep spiking of this kind will not cause a loss of power quality and require substantial fossil plants to provide balancing services, we favour the rapid development of large scale storage which will also act to provide firm capacity. Experimental deployments in Japan (illustrated below) and Australia have led the way, and we note with great interest that VRB Power Systems Inc. has recently sold 1.5 MW x 8 hour (12 MWh) battery system to the managers of the Sorne Hill Windfarm, a recently commissioned 32 MW windfarm in Co. Donegal.¹⁰² However, electricity storage is at present very costly, and applications are only rational in special economic circumstances, such as islands, and in cases such as offshore wind where the achievable capacity factors are high and there is reasonable proximity to centres of load.



37. Experimental 4 MW, 6 MWh battery at Tomamae Villa wind park, Hokkaido, Japan.

In keeping with the principles sketched above, we support tidal power, but consider that impoundment systems, although probably more expensive than tidal barrages, would be less damaging to valuable wetlands in places such as the Mersey and Severn Estuaries. Of course, these are capital intensive schemes and are therefore fraught with risk, but the power they produce is wholly predictable and the marginal costs after the investment has been paid off are negligible, remarks which also apply to tidal stream generation. The crisis in energy supply that the UK faces is acute, but the issue is global in nature, and many other countries will be seeking to solve problems similar to our own in the near future. If the UK can develop innovatory and economic solutions promptly it could enjoy significant first-mover advantages.

¹⁰² Announced 30 August 2006. See: <http://www.vrbpower.com/docs/news/2006/20060830%20-%20PR%20-%20Tapbury%20Sale%20-%20Ireland%20Windfarm.pdf>

3.6: Transport

TEC states:¹⁰³

Transport Commitments

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

3.6.1: Renewable Fuels and the Conventional Sector

We have already discussed our view that the UK would be well-advised to buffer itself against rising oil prices by initiating a Coal to Liquids program. Though valuable, the contributions of any single technology are necessarily limited. We therefore welcome the Government's commitment to fuels from renewable sources, a proven technology which is now growing rapidly. We fully endorse the prudent development of indigenous production of bioethanol and biodiesel, but we are concerned that legislation may create an incentive for the import of feedstocks from unsustainable plantations in ecologically sensitive areas of the developing world.

¹⁰³ TEC, p. 133.

3.7: Planning for Large-scale Energy Infrastructure

TEC states:¹⁰⁴

Measures to introduce new planning system for Major Energy Infrastructure

- *Government is committing now to introducing fundamental change to the planning system for major energy projects once the findings of the other Reviews (Eddington Study and Barker Review) are clear, later this year.*
- *Government will work with the Devolved Administrations to ensure that across the United Kingdom, planning systems for energy projects can reduce risk and uncertainty for developers and others, while maintaining the openness, fairness and accountability of the current system.*

Stage 1 – Setting the Strategic Context

- *Government is publishing today a statement of need on renewables, restating our commitment;*
- *Government will ensure renewables are firmly embedded in the forthcoming Planning Policy Statement on Climate Change. Government will work with the Devolved Administrations on equivalent guidance across the United Kingdom;*
- *Government will publish new guidance in England and Wales on CHP, later in 2006, for applications under s36 Electricity Act. It will provide more information on developers' obligations to give full consideration of opportunities to develop CHP;*
- *Government will publish generic guidance in England and Wales on s36 Electricity Act, including information on co-operation between developers and the transmission companies about joining-up on applications;*
- *Government will consult on new guidance in England and Wales on the consenting arrangements for reinforcements to existing overhead power lines later in 2006; and*
- *Government is launching today a consultation on a policy framework for new nuclear build.*

Stage 2 – Introducing Efficient Inquiries

- *Government will introduce new inquiry rules for applications under the Electricity Act, in Spring 2007;*
- *Government is committed to appointing a high-powered inspector for the most complex and controversial energy proposals; and*
- *Government will consult on options for the streamlining and simplification of the consenting regimes for gas supply infrastructure projects.*

Stage 3 – Timely Decision Making

- *Government will undertake further work on options to ensure appropriate and predictable timings for decisions on applications for energy*

¹⁰⁴ TEC, p. 148.

developments. An announcement will be made later this year in the light of other cross-Whitehall work on planning.

3.7.1: Authoritarian Planning

The Government's dilatory action in other areas, touched on repeatedly above in our discussion of the conventional sector, is dramatically contrasted with its aggressive determination to reduce the degree to which the local government planning system can subject proposals for energy infrastructure to scrupulous examination. This is far from progressive and in fact represents an unwelcome return to an earlier and less democratic phase of planning law. As sketched the changes seem to intend a dirigiste system which is incompatible with long established principles of local self-determination and only dubiously justified. The planning system plays a very large part in the practical governance of the United Kingdom, and it is a particular matter for concern that Government seems willing to contemplate major changes without full consultation of Parliament. It is difficult to avoid the suspicion that, faced with an energy crisis which is to some degree the outcome of well-intentioned but mistaken policy, Government is setting out to remedy the situation with an extreme measure which is in any case likely to be ineffective.

We are as aware as any of the need for firm electricity generating capacity, and for the renewal and modernisation of the United Kingdom's overall energy infrastructure, and insofar as the Government intends to reduce *unnecessary* delay there can be no objection, but it is not clear that this aim will be well served by a *weakening* of the planning system, which will almost certainly have the additional consequence of removing *legitimate* delay as well. The planning system has hitherto served to sharpen the focus of those proposing developments and helps to ensure that even if flaws elsewhere in the energy policy have spawned poor proposals these would face stiff criticism at local level, where the balance between impacts and benefits can be best understood.

In summary, we believe that **the Government is proposing a pointless and dangerous removal of due process in planning.**

The proposals are pointless since the removal of planning restraints cannot in itself bring forward high merit projects when the overall market structure, BETTA, is fundamentally flawed; and they are dangerous since relaxation of planning controls will invite wholly inappropriate proposals that are not in the national interest, and consume development effort and scarce capital.

We believe that the Government would be better advised to:

- 1 Revise BETTA to encourage high merit development proposals.
- 2 Provide the planning system with a clear set of well argued guidelines concerning the UK's needs, and then leave the local planning system to balance these against the negative impacts of any proposal in the usual way.

4 Commentary on *The Energy Challenge's* Implementation Plan

In this section we quote and comment upon the text of the Implementation plan provided in section 9.9 of *TEC*, under the heading 'Next Steps'.¹⁰⁵ The plan is clearly intended to realise the Governmental proposals outlined throughout the text, and already discussed in our previous section. In our commentary we quote each section verbatim, and then offer remarks upon it. In general, while it is manifest that the Government is or intends to be active, as our commentary progresses it will become apparent this activity is not always substantively decisive, with much being left to further consultation or delegated to the operations of the market. In view of the crisis onset which we have described above, particularly in electricity, we find this state of affairs unsatisfactory.

Carbon Emissions Reductions

Commitment to a carbon price: the Government is committed to there being a continuing carbon price signal which investors take into account when making decisions. This is particularly important given the scale of new investment required in United Kingdom electricity generation capacity. The EU Emissions Trading Scheme (ETS) is here to stay beyond 2012 and will remain the key mechanism for providing this signal. The Government will continue to work with its international partners to strengthen the EU ETS to make it more effective. We will keep open the option of further measures to reinforce the operation of the EU ETS in the United Kingdom should this be necessary to provide greater certainty to investors.

REF comments: The price of carbon in the EU ETS has collapsed twice since its introduction in January 2005. No investment plan could possibly be written against such a variable income, and we think it unwise of the DTI to place so much reliance on a trading system which is in its infancy and has yet to achieve stability. We find we agree with the story appearing from Reuters on 11th of July which also contained the opinion of Dr Tony White, a director at Climate Change Capital, who remarked that he 'was hoping they [DTI] might do something to cut investor risk of low carbon prices, (guaranteeing a minimum price) using a carbon tax or levy'.¹⁰⁶ What form such taxes or levies might take is unclear, but if the Government is to rely heavily on such mechanisms the stabilisation of carbon prices is so desirable that considerable civil service time could and should be devoted to this matter.

¹⁰⁵ *TEC*, p. 157–160.

¹⁰⁶ <http://www.climatechange-capital.com/pages/newsdetail.asp?id=209&terms=&searchtype=0&fragment=False>

Energy Efficiency

Improved Billing: *we will be consulting with industry in autumn 2006, on providing historic information on electricity and gas bills and will consider further improvements.*

No one can argue that information on bills should be as complete as possible and contain historic data. There seems no reason why customers should not access this information through their energy supplier, and this facility should simply become standard.

United Kingdom Energy Performance Commitment (EPC): *we will put forward a proposal for a mandatory emissions trading scheme, alongside other options for achieving our carbon reduction aims in the large non-energy intensive sector, and will invite views later in 2006.*

We support the mandatory labelling of new electrical goods and would propose all reasonable measures to enhance consumer awareness of the energy consumption of new goods. In fact, if energy prices continue to rise, consumers will demand such information.

Considering the maturity of low-energy lighting technology, we are disappointed that it has taken the Government so long to recognize its importance and we are surprised that fiscal measures have not already been introduced to make its purchase even more attractive.

Widely implemented, radical energy-saving measures could reduce the supply-side crisis over which we have expressed so much concern, and as an added benefit it can be noted that the cost of abating CO₂ from energy saving is usually negative.

We have no particular objection to a 'carbon' price and would support a cross-Europe floor price in the ETS. We agree with Dr White's call for a tax or levy that would give much greater clarity and would be simpler to operate, and believe that an extension of Governmental control in this area is desirable. These are matters best left to individual consumers, seeking to reduce their financial out-goings.

Code for Sustainable Homes: *we will announce the 5 Levels for the Code for Sustainable Homes later this year. All Government-funded housing will be required to reach at least Level 3 – significantly more energy efficient than current Building Regulations.*

There is a serious danger of bureaucratizing 'sustainability' and bewildering consumers with rules and regulations, resulting in public scepticism and resistance.

Design for Manufacture Competition: *English Partnerships (EP) will announce details of the second phase of the Design for Manufacture competition, using six sites across the country. EP will challenge the industry to build low cost, low carbon and zero carbon homes, looking at whole developments.*

The vague nature of the English Partnership brief does not bode well, and we have grave concerns over the cost effectiveness of this initiative.

The vast majority of homes that will still be in occupation in 2020 already exist and these consume more than 90% of energy in the private dwellings sector. We doubt that private householders will welcome a new governmental overseer for energy efficiency or that such an overseer will actually produce beneficial results. Private householders might appreciate advice as to how to increase comfort while saving energy saving, but high efficiency lighting, double glazing, loft insulation, draft exclusion, and similar measures, are intrinsically attractive and do not require Government intervention for their implementation. We agree that the householder needs to be protected from cynical and exploitative marketing, but these goals can be achieved via the usual Consumer Protection mechanisms.

We will conduct a feasibility study for delivering a low carbon Thames Gateway over the next 10 years. We will explore the scope for the Thames Gateway to become a model site for developing emerging technologies, eventually moving towards carbon neutrality.

The desirability of such an example cannot be questioned, though we wonder whether a costly feasibility study is really necessary when the fundamentals are so obvious to all. Furthermore, we cannot conceal our surprise that reference to this activity, which is in essence **tactical**, should appear in the Energy Review report concerned with **strategy**, and it confirms our general view that the Government is open to the charge of presenting incidental and peripheral matters, however worthy, as strategic action.

Review of Permitted Development Rights for Microgeneration: Department for Communities and Local Government will consult on changes to the General Permitted Development Order in the autumn. We aim to ensure that, so far as possible, all microgeneration is exempted from the need for planning permission.

Microgeneration is defined in the *TEC* (p. 62) as:

small installations of solar panels, wind turbines or biomass/waste burners that supply one building or small community, again potentially selling any surplus.

We are concerned that these warm words mask a lack of detailed engagement. Unless these technologies prove themselves economically and really do save energy, consumer disenchantment, which spreads extremely rapidly by word of mouth, will ensure that domestic renewables of this type are no more than a fad. In this connection we note that press cartoons are already appearing in which micro-renewables are portrayed as the province of cold-calling cowboy installers.¹⁰⁷ Such concerns appear to be shared by the industry trade body the Renewable Energy Association, which is in the process of launching an accreditation system, REAL (Renewable Energy Association Listed).¹⁰⁸ While we wish such endeavours well, they may not be sufficient to prevent a collapse of

¹⁰⁷ David Langdon, [Solar panel cartoon], *Spectator*, 302/9293 (16 Sep. 2006), 22.

¹⁰⁸ http://www.r-e-a.net/article_flat.fcm?articleid=20

consumer confidence, and we note with concern that *TEC* is itself thin on detail with regard to micro-renewables and quotes no clear examples of commercial and market ready products. While acknowledging the attractiveness of the concept of microgeneration we believe that no major *governmental* commitments should be made until more is known of its cost and commercial appropriateness. We have in earlier statements suggested that government might achieve more by simply removing tax from micro-generation related products, and allowing free competition and quality exposure to sort out the wheat from the chaff.

Energy Efficiency Commitment: *we will consult this summer on whether to extend the range of measures allowed under the third phase of the Energy Efficiency Commitment, considering micro generation and measures that affect consumer behaviour.*

While we wholeheartedly support the Government's emphasis on conservation and energy efficiency, and agree that the cheapest power and heat will always be that which is not consumed, we have concerns over the extent and intrusiveness of the Government's intentions. We fear that such close involvement in the private concerns of the United Kingdom's citizenry will prompt a back-lash of irritation rather than gratitude. We suspect also that the large number of administrators recruited by the Government to manage these well-meaning legislative systems may have similar effects to those brought in to measure the performance of education and health professionals. As is now well known, such monitoring brings questionable benefits and can induce disabling loss of morale among those being inspected. The potential for corruption and waste must also be matters of concern.

We also note that **the Government's often stated reluctance to interfere in the operation of the national and international markets for energy, which is populated by abstract commercial entities, sits oddly alongside a willingness to contemplate highly intrusive and quasi-authoritarian measures at the level of the private individual.**

Distributed Energy

Review of incentives and barriers: *the Government and Ofgem will lead a comprehensive review of the incentives and barriers that impact on distributed electricity generation in the current system. This Review will report in the first half of 2007.*

We generally support the development of more distributed generation where this could lead to a more thermally efficient use of a wider range of fuels, whether fossil or renewable, by co-production of heat and power. However, before the Government commits itself or the UK to major investments, we advise that it review the experience of Scandinavia in the use of village level power and district heating stations. In Denmark, for example, there are already over five hundred such installations, the fuels and technologies in use being diverse. Investigation will reveal a mixed history of commercial success and failure, much of which will be instructive for the United Kingdom.

Generally, small-scale power production is capital cost intensive and requires a high rate of utilization to ensure economic viability. Combined heat and power production, where the heat is used for district heating can only be fully utilized during the heating season, leading to a relatively low capacity factor. The problem can be complicated by the low efficiency of small power plants in the power only mode, whatever label is attached to the power cycle.

However, if gas prices rise in the medium term, as seems likely, distributed power generation opportunities such as biomass CHP installations would be sufficiently attractive for user/investors to form cooperative energy companies.

Foresight Project: *The Government will undertake a Foresight project on sustainable energy management and the built environment. The project will consider the potential future role and relationship of centralised and decentralised energy generation in delivering the United Kingdom's long-term energy goals. In order to do this it will look at scientific, technical and economic issues including: future systems for generating heat and power that are low carbon and distributed; transmission and distribution networks; and demand management. Demand management will range from reducing use of energy in buildings through materials and intelligence, to exploring behavioural, attitudinal and information barriers to changes in behaviour. The project will report its findings in autumn 2008.*

Our remarks under 'Distributed Energy' are also relevant here. We wonder, in addition, whether further delays are justified in relation to such simple measures. In this case, the operation of the market might be expected to produce prompt and decisive action.

Oil, Gas and Coal

New arrangements for providing improved information and projections for energy supply: *We will introduce new arrangements for the provision of forward-looking energy market information and analysis pertaining to security of supply, led from the DTI and working with key energy market players, to bring in one place relevant data and analysis on adequacy of future energy supplies, presenting long-term scenarios of future supply and demand, and identifying in a timely fashion areas where policy may need to be reviewed.*

In view of the overwhelming importance of fossil fuels it is highly surprising that such information was not collected and assimilated as a coherent and unified guide for policy and decision makers in the normal course of the DTI's work. This failure to carry out fundamental market monitoring reflects, in our view, the Government's history of optimism over security of supply. We welcome the evidence of a change of heart on this matter, and urge the DTI to ensure that the value of this aspect of their activities is pressed upon ministers and other elected representatives.

A Coal Forum: *the Government will set up a Coal Forum to bring together producers, coal-fired generators and other interested parties to help them find*

solutions to secure the long-term future of coal-fired generation and United Kingdom coal production.

Given the Government's failure to act on the excellent advice of its own Clean Coal Task Group we doubt that the Coal Forum will be any more effective or influential. We have commented extensively above on the timid approach of the Government towards Carbon Capture and Storage, and the strength of world-wide activity in the coal sector. After all the studies and consultations the Government has made on this subject, and knowing the large and positive impact implementation would make towards both energy security (increased indigenous oil and gas production and reserves) as well as the positive impact that would be made on carbon emissions, it is distressing that the Government seems so uncommitted.

Gas security of supply: *the Government will consult in autumn 2006 with both industry and consumers on the effectiveness of current gas security of supply arrangements, their robustness as we move to higher dependence on gas imports, and whether new measures are needed to strengthen them.*

The vague lassitude of this promise is breathtaking in the present climate. Doubtless the Government was acting on what it took as sound advice, but it should now admit that a belief in the effectiveness of the global energy market to provide for UK needs was naïve, and has committed the UK to over-dependence on imported natural gas. Furthermore, **lack of direction has allowed the market to drift, and it may already be too late to avoid an over-build of natural gas CCGTs and an under-build of other firm generation, particularly clean coal and firm renewables.** Leadership is required, but is not evident in this projection of further consultation.

Investment in United Kingdom oil and gas production: *the Government will work with industry to boost investment in the United Kingdom Continental Shelf (United KingdomCS) over the next 10 to 15 years.*

The main factor driving large players from the North Sea is the Government's tax régime in relation to the upstream oil industry. Admittedly, the rise in the price of oil will probably attract adventurous new companies, but it seems more likely that only the larger and more experienced oil companies can hope to make significant extensions to oil reserves in the United Kingdom sector.

Electricity generation

Renewables

Renewables Obligation (RO): *we are proposing to extend the level of the Renewables Obligation up to 20%, when justified by growth in renewables; and consult on 'banding' the RO to give more support to emerging technologies in autumn 2006. If, following this, the RO is to be banded, then we will consult further on the implementation.*

We will also be taking forward planning proposals that will impact on large-scale renewables projects (see 'efficient and streamlined' inquiries section below) and will be monitoring the progress being made by Ofgem and the transmission companies in resolving grid-related obstacles to the growth in renewables.

The Renewable Energy Foundation has long argued in favour of banding to reflect the varying merits and deserts of technologies, and we welcome this commitment to refine a system that is widely acknowledged to be a blunt, wasteful, and counterproductive instrument. However, its flaws are so grave, and there has already been such extensive consultation, that we do not believe that delay is needed or justifiable. Without prompt action the already parlous state of offshore wind can only become worse. We are concerned that the envisioned delay will:

- Create uncertainties that will drive investors away from the very projects that the revisions seek to support, and
- Leave an overwhelming attractive window of opportunity for schemes and technologies of lesser merit.

In summary, while the proposed revisions are laudable, the timetable is seriously defective, and will further exacerbate an already deeply unsatisfactory situation. We urge the DTI to accelerate revisions with all possible means.

Environmental Transformation Fund: *a new fund will be established to support renewable energy and other non-nuclear low carbon technologies. Details will be announced in the 2007 Comprehensive Spending Review.*

This dramatic non-market intervention may be welcome, but we will defer precise comment until the details are available. However, it is worth noting that this new fund is an implicit admission that the Renewables Obligation has failed to stimulate new investments in innovatory renewables.

Cleaner coal and carbon capture storage

Carbon Abatement Technology strategy: *we will formally launch the first call for proposals worth £10m under the strategy in autumn 2006, with a focus on the pre-commercial demonstration of key components and systems to support carbon abatement technologies.*

Carbon Capture and Storage (CCS): *the next step would be a commercial demonstration of CCS, if it proved to be cost-effective. Following HM Treasury's recent consultation on CCS, we will do more work on the potential costs of such demonstration projects. A further statement will be made in the Pre-Budget Report.*

It is our view that £10 million of public money will be wasted. There is ample evidence in the USA and Canada for the effectiveness of using CO₂ for EOR, and a 'demonstration' is not only needless but will in practice delay serious implementation by up to a decade.

Legal & Regulatory Framework: *the Government will continue urgent work to provide the legal and regulatory basis for CCS in the United Kingdom, and to enable CCS to benefit from the EU Emissions Trading Scheme.*

The United Kingdom Government has, laudably, made efforts to solve these problems, while others, such as the Norwegians, have simply forced a path through. However, the Government can with some justification be charged with timidity. As explained, the United Kingdom Government makes much of synthetic objections, mostly raised by Greenpeace, that sequestering CO₂ under the sea bed is illegal, citing the OSPAR and London anti-dumping agreements – or dangerous, citing occasional tragic loss of life caused by eruptions of *volcanic* CO₂ at Lake Naira in Cameroon. These latter arguments can be dismissed as mischievous, and the fact is that the OSPAR and London agreements do not affect the legality of injecting working fluids for the purpose of enhancing oil and gas recovery from undersea hydrocarbon reservoirs. There seems to be no reason against pressing forward with EOR, and arguing for further revisions to the treaties so that they can continue to prevent dumping of truly dangerous waste while permitting the benign process of CO₂ sequestration.

However, at the glacial pace of this discussion, the United Kingdom will be far down the production decline curve by the time significant quantities of CO₂ can be delivered to the United Kingdom's declining oil reservoirs.

Nuclear

Proposed policy framework for new nuclear power: *we are setting out a proposed framework for the consideration of the relevant issues and the context in which planning inquiries should be held. This framework would be set out in a White Paper to be published around the turn of the year. The Health and Safety Executive and the Nuclear Installations Inspectorate have already consulted on a revised system of licensing for nuclear power stations. They plan to issue guidance towards the end of 2006.*

The Government has been aware of the inevitability of nuclear closures since it came into power in 1997. However, after six years, and following extensive public consultation in 2003, the Energy White Paper of that year side-stepped any decision with regard to addressing the generation gap caused by the closure of nuclear capacity. Instead it was tacitly assumed that the construction of up to 27 GW of wind power and greater reliance upon Combined Cycle Gas Turbines would make the replacement unnecessary. This gambit may have been attractive politically, but was quite lacking in either technical or economic realism, a point that DTI now seems to have succeeded, to some degree, in conveying to Ministers. In retrospect we can see that it would have been wise and statesmanlike of the Government to have conducted a broad public debate in 2000, making it clear that if the UK opted to reject nuclear energy, this would entail significantly increased dependence on coal and gas, given that the contribution from renewables would be necessarily modest. Should this route have been selected there would have been time to ensure that the fossil generation sector was appropriately redesigned,

probably with CCS, and that the market channels for fuels were developed and guaranteed.

In the present situation many will argue that we no longer have the luxury of choice. On the one hand fossil rebuild is mandatory since we face a generation capacity shortfall which is so proximate that it cannot be addressed by a nuclear programme. On the other, some will say, that long-term energy insecurity suggests that a nuclear rebuild must be initiated immediately as a hedge against future uncertainty. Recrimination over the failure to initiate the nuclear debate at the appropriate time is arguably unconstructive, though it should serve as a reminder to future administrations that the energy sector requires long term planning and that unless awkward issues are confronted in a timely fashion choice may be constrained in a politically disastrous manner.

Thus, while holding the Government responsible for the current crisis, we appreciate the force of arguments suggesting that a nuclear component in UK energy is prudent. However, the Government's current emphasis on the reform of planning procedures, as if it is these procedures and not the extremely significant environmental and economic issues of a nuclear rebuild, is not encouraging, and we are deeply concerned that no serious public debate seems to be envisaged. It may well be that new nuclear power stations will deliver the safe, CO₂-free, reliable and economic power that their proponents proclaim, but the Government must engage in open and honest dialogue over this option. With appropriate seriousness the Government could succeed in this debate, but the fact that it seems to have little taste for engagement suggests that Ministers either lack confidence in the case or intend to proceed in an authoritarian manner that does not deserve public support.

Planning for large scale energy infrastructure

Strategic context:

Renewable generation: *the Government will ensure renewables are at the heart of the forthcoming Planning Policy Statement on Climate Change. We will consult on the draft Planning Policy Statement around the turn of the year. The new PPS will make clear that the location and design of new developments should strongly promote the reduction of carbon emissions.*

Climate change mitigation is the over-riding governing principle of *TEC*, and renewable energy is envisaged as one of the principle tools by which the Government hopes to deliver its policy.¹⁰⁹ We have shown above that after nine years of Governmental commitment, and considerable support from previous administrations, renewable energy is delivering less than 1% of the United Kingdom's primary energy, a fact which calls the Government's aspirations into question, and suggests very strongly that they are either technically misguided or insincere.

Cool-headed realism with regard to what is achievable is essential if we are to see the growth of a serious UK renewables sector delivering reduced dependence upon

¹⁰⁹ The Prime Minister, Foreword.

imported energy, increased supply security, and economically compelling reductions in CO₂ emissions.

However, we see no signs of such specific proposals or a drastic change in operating assumptions that would render credible the Government's belief that these targets can be met without causing serious damage to the British economy. If planning constrictions are indeed stifling the development of alternative energy production, then the proposed Planning Policy Statement on Climate Change should have been presented with *TEC*. Piecemeal publication gives the unfortunate impression that Government is attempting to achieve wrenching changes in planning practice through less than transparent measures.

Combined Heat and Power (CHP) Guidance: *the Government will publish new guidance on CHP, later in 2006, for applications under section 36 of the Electricity Act. It will provide more information on developers' obligations to give full consideration of opportunities to develop CHP.*

We support the Government's desire to see a marked increase in the use of CHP in the years ahead, wherever this is practical and economic, and we support fiscal measures to encourage developers to seek out and find locations where the combined generation of heat and power will save fuel and emissions.

Improved planning applications: *the Government will consult on guidance for section 36 Electricity Act applications around the end of 2006, including information on co-operation between developers and the transmission companies about joining-up on applications.*

We agree that planning applications for generation should be accompanied by a clear statement concerning the extensions or reinforcements to the distribution and transmission grid that will be entailed, and preferably by planning applications for any such grid work. Furthermore, and for the sake of transparency, we support the notion that in each case the economy of the proposed development be published at the same time. In this way, the planning inspector would have a clear view of the total economic and environmental impact such new developments will have. At present the picture presented to the planning system is fragmented, piecemeal, and obscure. This is unacceptable.

Nuclear generation: *the Government is launching today a consultation on a policy framework for new nuclear build, which will lead to a White Paper around the turn of the year.*

Efficient and streamlined inquiries:

New inquiry rules: *the Government will introduce new inquiry rules for applications under the Electricity Act. We will consult in autumn 2006 with a view to introducing new inquiry rules in spring 2007.*

Simplification for gas infrastructure: the Government will consult, in autumn 2006, on options for the streamlining and simplification of the planning process for gas supply infrastructure projects.

Predictable timings for final decision-making: the Government will undertake further work on options to ensure appropriate and predictable timings for decisions on applications for energy infrastructure. An announcement will be made later this year in the light of other cross-Whitehall work on planning.

It is hoped that these consultations will be broad and extend well beyond those organisations that will benefit directly from them. We are particularly concerned that Government will be perceived as seeking general compliance for a severely dirigiste revision of the United Kingdom's planning system without a full appreciation of what that revision will entail and legitimise.

Transport

Renewable Transport Fuel Obligation: the Government will be consulting with industry in early 2007 on increasing the Renewable Transport Fuel Obligation from the current 5%.

Whilst we wholeheartedly endorse the judicious use of domestically produced biofuels, we are concerned that in a rush to meet arbitrary targets a vacuum will be created which only imports can fill. This need not always be wholly negative, but there is a strong potential for creating a large incentive for undesirable and deeply unecological development overseas, for example the destruction of rain forest to grow palm oil. In short, the total environmental impact of the Transport Fuel Obligation needs to be examined, and more emphasis placed on the indigenous generation, which can be carefully monitored, has a more positive carbon balance, and offers enhanced benefits in relation to security of supply.

EU car fuel efficiency Voluntary Agreements: we will consult with industry on options to replace the current Voluntary Agreements when they expire in 2008/09. We will explore all options including mandatory measures with trading.

It is difficult to see why delay on this matter was thought necessary or desirable.

Surface transport in the EU Emissions Trading Scheme (ETS): the Government will continue to participate in the European Commission's Review of the ETS and press for serious consideration of the inclusion of surface transport.

This would be quite unnecessary if there were mandatory and tightening fuel efficiency requirements for vehicles.

Appendix 1: Summary of the Renewable Energy Foundation's response to the Energy Review consultation

The following text comprises the Summary of Response contained in the Foundation's formal response to the Energy Review consultation. The full text is available from the www.ref.org.uk.

1. In view of the fact that the United Kingdom produces only 2% of the world's emissions, a proportion which is falling due to growth in the developing world, it is axiomatic that **our climate change policy should aim to provide a qualitative rather than a *quantitative* example.**
2. It is only by providing an *economically* compelling lead that we can hope to draw the developing world with us, and consequently **security of supply and affordability must be the foremost goals of our policy.** Self-harm in the United Kingdom will be a poor advertisement for clean energy.
3. Premature or idealistic deployment of renewables will fail to contribute to an economically compelling example and will also fail to ensure a healthy future for the renewable energy sector.
4. There is an optimistic tendency at present, prevalent amongst non-engineers and the environmental lobby, to claim that a predominantly or wholly renewable energy future awaits us, and consequently that our current task is to find an interim solution. This view is particularly widespread in relation to electricity. However, it is extremely unlikely to be correct. **The scope for renewable energy, particularly in electricity, will almost certainly be severely constrained either technically or economically, or both.**
5. Misrepresentations of the role of renewables are causing widespread public misunderstanding of the issues facing the Government in its energy review. **The Foundation judges that renewables are being asked to deliver more than is feasible, and that the sector is being set up for inevitable failure.**
6. We urge the Government to do everything in its power to ensure that the public understands that while renewables are desirable, and indeed essential (particularly in heat and transport), their contribution in the short term can only be modest, however valuable, and is likely to remain so.
7. The popular 'renewables v. conventional energy' debate is grounded in a false dichotomy. Renewables, even firm generating renewables, including large projects such as the Severn Barrage,¹¹⁰ cannot obviate the need for conventional

¹¹⁰ The Foundation acknowledges ecological concerns with regard to the Severn Barrage concept, and believes lagoons may be a viable way of realising this resource without damaging environmental consequences.

generation in strategically significant quantities in the short, medium and probably longer term.

8. Unreasonable and aspirational visions of a **predominantly or wholly renewable energy future should not be permitted to distort contemporary policy by encouraging the belief that our present need is to construct a short-term or bridging strategy**. On the contrary, as a matter of social responsibility the Government should aim to produce an energy system which is *robust in the long term* and thus insures the UK and its people against risk. Renewable energy will play a part in this portfolio, and the UK should certainly be in a position to take advantage of breakthroughs in the sector, but **there is nothing to be gained for the UK and its people, or for the world at large, by exaggerating the likely role of renewables or banking on rapid technological progress**.
9. The Renewables Obligation system of indirect subsidy for renewable electricity is flawed, is in a state of protracted failure, and is resulting in a significant misallocation of resources. **The RO's principal defect is that it hyper-incentivises low capital cost renewable technologies irrespective of intrinsic merit**. Thus, investors are almost exclusively focused on onshore wind at the expense of higher merit technologies such as
 - i. Biomass, which is fully dispatchable.
 - ii. Tidal stream and tidal barrage and lagoon systems, which are predictable with a high degree of certainty, and in the case of lagoons could offer some degree of energy storage.
 - iii. Offshore wind, for which capacity factors are much higher and for which locations in proximity to centres of load can be more readily found. **We fully endorse the finding of a recent report for the British Wind Energy Association that a 'New Policy Impetus' is needed to ensure that offshore projects fulfil their potential.**¹¹¹
10. The intention of the Renewables Obligation is to levy a subsidy on the consumer to fund support for immature technologies that would otherwise not be brought forward to market. However, it has provided excessive and to some degree undeserved support to two near-market technologies, namely:
 - i. Landfill Gas (though this is not a growing problem since available sites are now largely developed), and
 - ii. Onshore wind, which in good locations, can now generate electricity at costs of the same order of magnitude as conventional plant.¹¹²

¹¹¹ BVG Associates and Douglas Westwood, for the BWEA and Renewables East, *Offshore Wind: At a Crossroads* (April 2006). Available from <http://www.bwea.com/pdf/OffshoreWindAtCrossroads.pdf>.

¹¹² PB Power, *Powering the Nation: A review of the costs of generating electricity* (Mar. 2006), pp. 18-21.

11. **The degree of over-support for near-market renewable technologies is significant in degree**, and is tending to suppress growth in other renewable technologies, some of them capable of firm generation.
12. Oversupport for onshore wind is still more undesirable since wind is, relative to firm renewables, a lower merit technology, a fact now richly evidenced in empirical data from Germany and Denmark. This evidence shows that:
- i. The degree to which wind power can replace conventional capacity is low (German grid operators estimate that 48,000 MW of wind will replace only 2,000 MW of conventional plant), with implications for overall system costs.
 - ii. Large scale expansion of the grid is required solely to mitigate grid balancing difficulties consequent on wind.
13. Achieved capacity factors for onshore wind in the UK are not promising, and suggest significant regional variations, with important implications relating to the likely concentration of the UK's wind carpet, and its remoteness from centres of load.
14. Theoretical arguments proclaiming the irrelevance of German and Danish experience are misleading, and exaggerate the distinctions between the UK wind resource and the likely behaviour of the UK wind carpet. We note with concern that several of the most misleading of these studies have been issued by Government-funded organisations, or with the DTI's imprimatur, or accompanied by press releases including approving statements attributed to the Rt Hon Malcolm Wicks, MP, Minister for Energy. In our view and that of many other expert analysts, these documents are potentially misleading.¹¹³ We are deeply concerned that the Minister has been drawn unwittingly into false and risk-prone positions. **If these studies are allowed to direct policy the resulting energy future for the United Kingdom would be both sub-optimal and prone to deliver unpleasant surprises.**
15. Realism with regard to renewables, and other technologies, is crucial since **an energy policy which is not manifestly grounded in practical self-interest will deter global investment in the United Kingdom's economy**, with disturbing implications for employment and the well-being of the population.
16. Renewables in general are, unfortunately, a relatively expensive means of reducing CO₂ emissions, and applications are necessarily limited in scale. The United

¹¹³ We are particularly concerned by the quality of guidance currently being inferred from the following studies: 1. Sustainable Development Commission, *Wind Power* (May 2005); 2. Graham Sinden, *Wind Power and the UK Wind Resource* (Environmental Change Institute (for the DTI): Oxford, 2005). 3. Graham Sinden, 'Characteristics of the UK wind resource: Long-term patterns and relationship to electricity demand', *Energy Policy* (2006); 4. Robert Gross, et. al., *The Costs and Impacts of Intermittency: An assessment of the evidence on the costs and impacts of intermittent generation on the British electricity network* (UK Energy Research Centre, Apr. 2006).

Kingdom's climate change policy must take precedence over its renewable energy policy, and therefore **it is of vital importance that we concentrate on planning an economically compelling system of clean and efficient conventional energy provision, particularly in electricity, and with that foundation assured then, and only then, seek to add as much renewable energy as can be economically and sustainably generated.**

17. The Foundation acknowledges widespread public concerns with regard to the operation of nuclear power stations, and the safe disposal of waste, but believes it irresponsible and unhelpful to propose renewable energy as an alternative. It is a matter of practical logic that if the UK chooses, after public debate, and via the democratic process of parliament, to reject the nuclear option, the country's future electricity system will have to depend on a portfolio of conventional plant overwhelmingly comprised of gas and coal. Irrespective of the amount of wind added, this conventional system cannot be smaller than peak load, plus ten per cent safety margin.¹¹⁴ Firm renewables such as biomass and tidal would be able to reduce the coal and gas fleet in this scenario, but their contribution would be necessarily limited.
18. In order to enhance the contribution from non-firm renewables **we urge Government to ensure that developers are encouraged, by variable reward within the subsidy system, to design electricity storage into their plans for stochastically intermittent or variable renewables**, thus providing 'in house smoothing' of output for projects such as offshore wind, which, as noted above, have intrinsic merits such as high capacity factor and potential location in proximity to demand centres.
19. Regardless of whether the UK decides to renew the nuclear build or not, coal and gas will be a major component in our portfolio for many decades to come. This, and the prospect of rapid growth in fossil fuel electricity generation in the developing world, indicates that **the United Kingdom would contribute powerfully to global climate change policy by ensuring that it contributes vigorously to the application of carbon capture and sequestration technologies.** This is a position that the Foundation has advocated from its inception.
20. Resulting from the Renewables Obligation distortions and misdirections of resources within the renewable electricity sector are having a spill-over effect on the rest of the portfolio, where there is little incentive for conventional plant development upon which the future prosperity of the UK will depend.
21. The excessive incentive of the Renewables Obligation has also resulted in undue concentration on electricity generating renewables and has drawn investment

¹¹⁴ Michael Laughton, 'Power Supply Security with Intermittent Sources: Conventional Plant Capacity Requirements', *Power in Europe*, 460 (10 Oct. 2005).

away from renewable and innovative alternative technologies for heat and transport.

22. We welcome the publication of the recent DTI strategy document on micro-generation,¹¹⁵ and trust that this heralds a period of novel emphasis on combining renewable and alternative energy generation with energy saving and low-energy innovations throughout our society. **If approached with realism and prudence microgeneration technologies can make significant contributions to reducing national and personal energy consumption in the long term, thus enhancing competitiveness and domestic prosperity.**
23. Alternative electricity generation which lies outside the Renewables Obligation, such as Energy from Waste, is comparatively neglected. Given the future challenges of waste disposal and the potential generation from Municipal Solid Waste alone (ca. 25 TWh of firm electricity) this is as regrettable as the suppression of firm renewables.
24. **The Renewables Obligation is harming the United Kingdom, weakening its climate change policy, and blighting the future of the renewable energy sector. As a matter of urgency the RO must be revised.**

¹¹⁵ DTI, *Our Energy Challenge: Power from the People* (March 2006). Available from <http://www.dti.gov.uk/energy/environment/microgeneration/strategy.shtml>.

About this Report

This Report has been written by Dr John Constable,
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