

# CABINET OFFICE PIU ENERGY POLICY REVIEW

## SUMMARY OF KEY THEMES AND POINTS IN THE SUBMISSIONS

By Professor John H Chesshire

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### A. INTRODUCTION

#### A. 1. The Purpose

The aim of this paper is to summarise the key themes and major points made in the submissions received in response to the PIU's invitation. Numerous submissions arrived after the target date of 10 September. This paper reviews some 285 submissions received by the author by 29 September.<sup>1</sup> All but 5 of these were from the UK. Some submissions were confidential in whole or in part. No reference is made here to such confidential information. Others attached several supporting papers and reports.

The welcome scale of the response, the time limit imposed for preparation of this paper, and the aim of producing a workable document have all imposed severe constraints. In particular a bullet, rather than an essay, style has been adopted for the bulk of this paper; and the original aim of footnote references was abandoned.<sup>2</sup> This has made it somewhat more difficult to 'weight' the support for specific proposals. A very large number of responses focused upon new and renewable sources of energy and nuclear power. This text does not review the Scoping Notes, which are taken as read; and little use is made here of numerical data on emissions, energy production, use, reserves etc. given space limitations. The paper is grouped into sections as a means of marshalling the major themes and points. In some cases the divisions are somewhat arbitrary. The author has sought to serve as an 'objective' rapporteur.<sup>3</sup> At some, clearly identified points the author notes a few issues. These are areas so far treated with less emphasis in the submissions but which the author considers merit further attention both by stakeholders and the PIU. Time constraints meant that not all submissions could be sent to the author for review. However, it should be stressed that all submissions are being reviewed in detail by the PIU team, even if not listed in the Appendix to this summary. Thus there is no danger that specific points made in submissions will be overlooked, even if it is judged that they are not adequately reflected below. A full list of submissions received by the PIU is available on their web site.

#### A. 2. The Approach

Virtually all submissions welcomed the Review, the opportunity to contribute to it, the open approach adopted via the website, the prior preparation of evidence by the DTI and the initial

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<sup>1</sup> A list of the submissions reviewed is given in Appendix 1, categorised broadly by key stakeholder groups.

<sup>2</sup> Pagination and paragraph numbering of submissions would greatly assist such summaries. They should be requested for all submissions in future consultation exercises of this type.

<sup>3</sup> The author wishes to record that no influence, nor pressure of any kind, were exerted by any organisation in preparation of this paper. All errors and omissions are his responsibility.

Scoping Notes by PIU, and the efforts made to engage in further debate with stakeholders via meetings and workshops. There is also strong support for the need to examine the UK's options within a wider EU and global context, and over a time scale up to 2050. However, comparatively few submissions to the Review examine a time horizon beyond 2010-20; and few examine EU or global issues in any depth. Some respondents think a 50-year look is ambitious, noting that political and business horizons are usually very much shorter. The choice of intermediate dates for analysis and for interim targets, such as 2010 and 2020, is supported. It was suggested that the development of a few, vividly illustrated, energy scenarios might well assist wider public engagement during and after the Review. For example, one scenario might examine the likely outcome if present market trends continued; and other scenarios the impacts of differing amounts of embedded and local generation. It was stated that all past projections of future energy demand and supply had been wrong: there was no reason to expect current efforts to prove any different!

Several questioned the haste of the Review, stating that the issues were complex and required adequate time for careful reflection and debate with stakeholders. The Review is addressing difficult and long-term challenges - with huge potential benefits if wise decisions are taken, but huge costs if not. One submission considered the Review should have taken the form of a public inquiry, permitting cross-examination; another suggested Government use of e-mail to all households to identify views, preferences and proposals. In addition, a 'one shot' review is judged unlikely to resolve all the issues under consideration and a rolling, periodic (say 5-year) programme of policy evaluation is seen to be essential. One submission suggested possibly too many issues had been identified, stressing the crucial importance of focusing on key elements which could align (or minimise the trade-offs between) the three main pillars of competitiveness, the environment and supply security. But modern policy making is a complex business and very many stakeholders - reflecting widely varying perspectives - are quite properly engaged. Previous UK and foreign experience at formulating national energy policy suggests that the Review and subsequent decisions will not be an easy task. Some said the Review should result in a 'to the Government' - even a 'to the people' report, given the unprecedented ethical and moral issues now raised by energy and environment issues. Some favoured eventual publication of Green/White papers to permit further opportunities for careful reflection on crucial issues.

### **A. 3. The Broad Policy Context**

Much has happened recently in UK, EU and global energy markets. In particular, the UK has enjoyed a high degree of energy self-sufficiency over the past 20 years, but this situation is widely expected to change over the next two decades. UKCS oil and gas production is near its anticipated peak, although production might be as high as 3 million boe/d in 2010. Uncertainties are considerable, but the UKCS is projected to continue to produce considerable quantities of oil and gas up to, and beyond, 2030. But by 2020, on present DTI estimates, up to 55-90% of UK gas requirements might be imported. UK coal production has declined steeply since 1985 whilst imports have risen. The UK's present nuclear plants, other than the Sizewell B PWR, will retire by 2020-25.

Concern over environmental impacts, especially climate change, has emerged as a significant policy driver; as, too, has social inclusion - especially tackling the scourge of fuel poverty. CHP and renewable technologies are making progress but, as yet, their eventual contribution remains uncertain and unfulfilled - partly because of recent electricity market reform (NETA). Modest progress has

also been made in reducing the UK's carbon and energy intensity, and in tackling fuel poverty, but more decisive action is now needed. The UK is on track to meet its Kyoto commitments of a 12.5% reduction on 1990 in greenhouse gas emissions by 2008-12, largely a result of the essentially fortuitous 'dash for gas'. Yet, if the IPCC and RCEP views are accepted, the Kyoto commitments are but the first of a series of increasingly demanding reductions in greenhouse gas emissions. On present trends, the UK appears unlikely to sustain emissions reductions much beyond 2010 unless further decisive policy action is taken. The UK is responsible for 2% of current global greenhouse gas emissions. Given this some submissions took the view that UK policy should evolve in step with other countries' policies; and warned that a 'ground breaking', unilateral approach by the UK might undermine competitiveness. On the other hand, especially as regards R&D, demonstration and technology deployment, the view was often expressed that - with suitable policies and financial support - the UK could exploit 'first mover' advantages in some technologies and services in the global markets.

The energy policy objective of recent governments has been defined as ensuring secure, diverse and sustainable sources of energy at competitive prices. But, over the past 20 years, perhaps the dominant strand of UK policy for the energy sector has concerned privatisation, market liberalisation and establishment of new regulatory frameworks. Many submissions recognise that - now - the balance between the three policy 'pillars' (competition, the environment and supply security) needs to be re-examined carefully and perhaps struck in different ways. Such re-weighting suggests new frameworks for policy makers are required and that yet greater emphasis must be placed on policy integration - especially between the demand and supply sides of the energy sector.

No longer can energy policy be concerned narrowly with the energy 'sector' - with fuel policy and the flow of energy commodities. Rather it is the energy 'system' which must be placed in much sharper relief, harnessing the stock of energy-using capital goods (homes, appliances, vehicles and machinery), energy commodity flows and the energy supply infrastructure (including diversity and storage), for the provision of sustainable energy services. Many submissions said the energy system infrastructure must be viewed in even wider terms, especially education, manufacturing capability, R&D and the knowledge/skills base, given recent erosion of capacity in these important enabling fields.

Any emerging policy framework should embrace care of the environment, competitiveness and price stability, security and diversity, and social policy considerations. It should be precautionary and transparent, and identify accountability for achievement of outcomes. Priority should be given to least-cost and 'no regrets' options which satisfy multiple objectives and which contribute clearly to desired outcomes. Only Government can manage the trade-offs involved but it can seek advice and guidance from many sources. Where possible, the aim should be to maintain flexibility without distorting the commitment and slowing momentum. But short-term decisions should pay proper regard to long-term aims.

At least some of the potential conflicts between the main pillars are judged to arise because often the objectives are focused not on the final *outcomes* being sought but on the *means* of achieving them. Specification of outcomes, sometimes by indicative targets, is judged by many to be more important than specification of means. For example, some submissions suggested different target mixes for the UK primary energy demand balance, or for the power station mix. Many other submissions

considered this approach most unwise, as it would constrain the means by which competitive markets could be harnessed to achieve the required outcomes at lowest long-term cost. Thus whilst the RCEP's target of a 60% reduction in carbon emissions would in principle be acceptable as a target or an outcome, allocation of market shares to specific fuels or technologies would not be.

Markets are most likely to achieve successful outcomes if they are designed to reflect all the costs and benefits judged important by Government and society. These pertain to the environment, diversity, security, health and safety, competitiveness and social inclusion (fuel poverty). However, markets are unlikely to 'internalise' these. Here lies the role of Government. Instruments such as the Renewables Obligation are widely applauded, as this approach provides a framework as to intended direction but does not seek to back specific technologies. The market, influenced by the planning process, will assess which renewable sources and technologies are best deployed at least cost over say a 10-year time frame. Government might also wish to assist other technologies with direct support for R&D and demonstration, if only to ensure additional options are available - over longer time frames - for eventual market deployment. Here choice of technology or fuel is more complex.

Many submissions recognise the need to identify more sustainable, low-carbon pathways<sup>4</sup> over the next 50 years and longer; and to devise means to re-align liberalised economies and their energy systems towards these pathways. The Review could establish a road map into the future and identify options, opportunity costs, instruments and institutions. Many said the Review should be set within the framework of sustainable development. Similar policy and market responses are required elsewhere in the UK and global economies. The energy system, alone, should not bear the whole burden of this profound transformation.

A fairly clear distinction is apparent between those who place predominant reliance upon the market, over time, to respond to light nudges upon the tiller; and those who judge that the intensity of policy intervention may well need to increase in liberalised markets. Nearly all recognise that the market by itself will not wholly satisfy what are variously described as 'public interest obligations', 'externalities', or 'strategic' policy concerns such as environmental impacts, health and safety, international diplomacy, more balanced regional development or supply security. A key issue - even when new frameworks are put in place - is the degree to which competition and market forces are used to deliver the desired responses.

The overall Scoping Note states that 'competitive markets will continue to be central to energy policy'. It is, at present, difficult to discern how many of the desirable developments along a more sustainable pathway (such as technological change) might flourish *without* significant policy intervention in a competitive market. It is only when such a view is taken that the form, extent and rigour of further policy and regulatory intervention can be assessed. Numerous submissions expressed severe doubt about the ability of market forces to 'square the circle'. Many argued that Government should set the framework, or the boundary conditions. Many also considered that, guided by policy, regulation and market-based instruments, competitive market forces could be used to secure the least-cost route.

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<sup>4</sup> In this context, sustainability must be understood to embrace the three strands of (i) mitigation of environmental impacts, including climate change; (ii) diversity, endurance, flexibility and supply security issues; and (iii) equity and social inclusion – i.e. the ability of ecosystems and human systems 'to bear up without collapse'.

Liberalisation has brought many benefits, particularly lower energy prices. But many judge that ‘business as usual’ - and especially ‘business as usual with lower energy prices’ - will not be consistent with more sustainable pathways. One of the foremost priorities for integration is to reconcile market messages and policy messages. The overall policy framework, and the combination of policy instruments chosen, should aim to support and encourage the transition to a low carbon economy and at least cost. Wherever possible the greatest degree of coherence should be sought between the main policy areas or pillars. The process of achieving such coherence essentially involves (i) identifying and promoting synergies and (ii) mitigating conflicts between the main policy areas. This is easy to state, but rather more difficult to realise in practice given ignorance and genuine uncertainties over a time scale to 2050 and beyond. But a timeline, or critical path, towards objectives can be identified and intermediate time horizons chosen to facilitate the process. A key issue is about how to get the balance right between short- and long-term costs and long-term objectives.

Liberalisation, privatisation and State Aid policy requirements have had a major influence on the ‘*instrumentality of policy*’ – i. e. why and how governments and regulators can intervene, even if they choose to do so. A balance between freedom and regulation encapsulates much of human endeavour. Likewise, the balance between markets, regulation and other explicit policy intervention in the energy system needs to be kept under scrutiny. As any new framework is established, a degree of pragmatism is likely to be required as to the form, force and longevity of such regulation and policy intervention. Pragmatism also applies to the choice, and the precise form and reach, of policy instruments over time - essentially market-based or regulatory, fiscal or physical (e.g. taxes, subsidies, building regulations, minimum performance standards, obligations, carbon trading, R&D). The choice should be influenced by rigorous analysis and concrete evidence, rather than by predilection or prejudice.

The objective should be to stimulate smooth market transformation towards the chosen pathways and to avoid abrupt changes in the policy and regulatory framework. Barring a major re-balancing of objectives to reflect new market or policy concerns, a broadly consistent course must be steered. Given long asset lives and the capital intensity of the energy system (on both demand and supply sides) the resource costs of abrupt changes could be very considerable. This means it is imperative to attempt to secure a degree of cross-party support and indeed fuller international agreement on the chosen framework.

## **B. SUMMARY OF KEY THEMES AND POINTS IN THE SUBMISSIONS<sup>5</sup>**

### **B. 1. Energy Demand, Conservation, Efficiency and Fuel Poverty**

- It is sensible to commence this summary of submissions with the demand side. Energy demand is a derived demand. Final consumers require energy services (heat, light, cooling, communication etc.) rather than units of fuel and power. Thus several submissions said competition in provision

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<sup>5</sup> The bullet point order is of no particular consequence although, usually, general points precede detailed ones. The length of each main section broadly reflects the volume of submissions received on these topics.

of such services, rather than merely in commodity energy supplies, is to be encouraged. The industrial energy services market is fairly well developed, but this is not yet so for the commercial and residential sectors.

- An Energy Efficiency Strategy to 2010+ should be developed to give targets and clear strategic direction; ensure better co-ordination of efforts between all major actors (energy suppliers, manufacturers and retailers); and identify funding sources for, and barriers to, a much higher level of activity.
- Market transformation efforts and energy service provision should be much expanded. Barriers to development of the latter should be explored further and overcome. Some submissions sought abolition, or else greater flexibility in interpreting, the '28 day' rule. Building regulations must be progressively tightened for new and existing buildings. Energy and emissions labelling should be introduced. Home energy rating is required, and could be measured when new mortgages are taken out.
- Many submissions argue that minimising energy demand - or at least greenhouse gas emissions - through conservation, energy efficiency and CHP must be at the core of sustainable energy policy. Reducing demand curbs environmental impacts and fuel poverty, enhances supply security, and can create employment - a 'win-win' position.
- Energy demand and supply issues should receive equal weight in the Review. Both supply and demand options should be examined in similar ways (e.g. £/tonne of carbon avoided). Efforts to quantify a carbon abatement curve are a priority.<sup>6</sup> The EST states the Energy Efficiency Commitment (EEC) will lead to carbon savings for 'UK plc' at negative cost (including bill savings and comfort benefits, estimated at -£215/tonne of carbon). This must be analysed carefully. If correct, the implications are profound and suggest very considerable further scope for 'intra-marginal' carbon savings.
- Many submissions state there is a huge technical potential for energy savings in buildings, via new build and retrofits, and via replacement of appliances/lighting with more efficient equipment. Much of this is also cost effective, even at current energy prices. The key issue is to find effective means of accelerating the exploitation of this potential (e.g. energy labelling, minimum performance standards, taxes, grants, tax allowances and other incentives such as reduced stamp duty and VAT at 5% for approved energy efficiency products and for CHP). Wide deployment of insulation, efficient lighting, condensing boilers, efficient appliances, micro-CHP, solar, heat pumps, controls, smart communication and net metering technologies etc. should be further developed; and innovative tariff structures explored. Accompanying 'soft' measures are necessary: installation regulation, installer/service engineer training etc. Long-term education campaigns are required to inform behaviour and influence attitudes, with emissions information on bills.
- Particular effort is required to tackle growth in commercial/service sector energy demand. The need for air conditioning should be minimised or eliminated. Benchmarking and independent accreditation of energy/environmental performance in commercial, industrial and public sector buildings should be intensified, as should environmental reporting.
- Some of the UK housing stock is amongst the worst in the EU. Currently only 15,000 houses are demolished each year in the UK. The average SAP rating of houses must be raised. Excluding fuel poverty expenditure, it is said only some £40 m/yr. of public funds is currently

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<sup>6</sup> As the DTI Energy Advisory Panel states, it is not possible to draw the UK's marginal benefit curve for CO<sub>2</sub> emissions reduction.

spent to encourage energy efficiency in 16 m homes of those not on benefits. This is considered wholly inadequate.

- Efforts to tackle fuel poverty are widely welcomed. But the Fuel Poverty Strategy should be more ambitious, anticipate rising fuel prices and be better co-ordinated across schemes/agencies. Energy efficiency is the only sustainable solution to fuel poverty.
- Finance will be crucial: leasing, grants, subsidies, earmarking of funds, integrated bills (for supply and repayment of equipment out of savings), and changes in financial rules for public and local government finance etc. A major focus should be on the existing building stock, not just via fuel poverty programmes.
- The energy savings from increased recycling of raw materials and wastes should be calculated; and more radical steps taken to improve the UK's poor waste minimisation, re-use and recycling record.
- The increasing fragmentation of energy efficiency, low-carbon and fuel poverty institutions and programmes is causing confusion and wasted effort, particularly in the domestic sector. Rationalisation of agencies/Trusts is now required to provide more seamless, 'one-stop' provision. The role of local authorities should be enhanced; and access to essential (but 'anonymised') data held by utilities should be available to local authorities.
- But others claim conservation and energy efficiency might only shave the continuing growth in energy consumption given the 'rebound' effect.

## **B. 2. Transport**

- Transport stands out as the main area of energy consumption and emissions growth in the UK to 2020. Numerous submissions emphasised the anticipated growth in emissions from this sector and the failure of policy initiatives, as yet, to dent growth in road and air transport. Transport should feature even more explicitly in the Review, given its heavy oil dependence, its wider environmental 'footprint' and the fear that efforts made elsewhere to reduce CO<sub>2</sub> emissions could be negated by growth in transport.
- The critical dependence upon oil for transportation must be addressed. Much recent debate has focused upon supply security in power generation, but transport merits equal attention.
- Planning major modal shifts requires a long-term (20-30 year) strategy. The planning system, for land use and infrastructure, should be harnessed to assist the long-term goal of more sustainable development. In particular, existing rail routes cannot absorb the projected increase in passenger and freight traffic, arising from a quite modest modal shift to rail, even with longer and double-deck trains. Several submissions commented upon the poor quality of much of UK public transport and argued for greater investment in it as part of a long-term energy and transport strategy.
- Vehicle fuel efficiency and emissions standards need to be much more ambitious and demanding, to force the pace of technological change. Increased Government/EU funding and incentives are needed for suppliers to develop a 'clean fuel' infrastructure. Fiscal changes are needed to keep clean fuels, including biofuels, cheaper than diesel and petrol; and to differentiate VED for vehicles on EST's Powershift and CleanUp registers. An EU-wide tax on aircraft fuel should be introduced.
- The use of hydrogen as a transport fuel is advocated by some, developed in conjunction with fuel cell technology. A logistical framework for converting filling stations is required. The energy

balance and safety implications of a hydrogen/fuel cell cycle should be fully evaluated (see also Section B.6).

### **B. 3. Combined Heat and Power (CHP)**

- CHP is a very cost-effective way of reducing CO<sub>2</sub> emissions. The Government's current target is for 10 GWe of installed CHP capacity by 2010. CHP potential by 2020 could be 19 GWe. Biomass-based and micro-CHP offer yet further potential.
- But several difficulties, especially NETA, the CCL and the combination of high gas/low electricity prices, mean that few new CHP plants are now being ordered. CHP schemes exporting via a third party (e.g. the Grid) are subject to the CCL, leading to recent cancellation/deferment of several CHP projects. Eligibility of 'good quality' CHP for enhanced capital allowances is undermined by the Treasury's reluctance to extend such arrangements to finance leasing, a common route for CHP investment. These and other impediments facing wider CHP deployment (e.g. excluding off-site sales power sales from the proposed UK Emissions Trading Scheme and issues of embedded generation and network access) require urgent review.
- Domestic and community scale CHP should be encouraged, including in rural areas. Barriers facing small-scale CHP must be addressed, such as: means of demonstrating high operating reliability; connection arrangements; common generation quality standards; pricing agreements and net metering; the effect of property sales/changes in tenure on financing risks; and whether/how energy service companies might assist deployment. The role of smaller, industrial gas turbines in CHP plant configurations should not be overlooked.
- CHP requires strong, effective and consistent support across several Government departments/directorates. An 'Office of CHP' could be incorporated in a Sustainable Development Agency. Government should consider the introduction of an energy supplier obligation for electricity from quality CHP, expressed in TWh/yr.

### **B. 4. Coal**

- Coal has the largest geological resources of any indigenous fossil fuel. Economic reserves, accessible with present technology and prices, are much more modest but still significant.
- It is argued that UK policy on coal should distinguish more clearly between (i) the role of coal from any source in the energy mix on grounds of economics, diversity and security; and (ii) policy towards UK coal production.
- International and UK coal prices will be set by coal-on-coal competition. Prices are relatively stable; could remain broadly in the range \$35-45/tonne in the short/medium term; and there is minimal risk of an OPEC-style cartel emerging. Port capacity can be expanded to handle more imports; but there are some constraints in rail transportation. Import prices are influenced by the \$/£ exchange rate, and by cyclical movements in coal shipping rates.
- Reliance will continue upon coal-fired generating plant in the UK and globally. But, without support, it was suggested all existing UK coal-fired stations could close by 2016. The introduction of yet tougher emissions requirements and of carbon trading will have a deleterious effect on coal, especially if electricity generators are included in any scheme.
- Advocates said coal should have a continuing role in the mix, especially power generation. Recent DTI projections have underestimated UK coal use (which has risen recently given higher gas prices and lower nuclear output). Coal provides a reliable and flexible option and is easily

stored. EU proposals for minimum stockpiles of fuel should include coal. For the foreseeable future, especially with any large increase in renewable-based electricity generation, coal has a crucial role to play in electricity supply security. Coal plant currently provides much of the shaping flexibility to meet the national electricity load profile. Nothing else is yet capable of performing this role, on this scale, at an acceptable cost. But, if low- and mid-load factor coal-fired plant is to remain economic, it is necessary urgently to review the burden of business rates and use of system charges – both of which are levied according to plant capacity rather than plant utilisation. At low load factors these two costs currently represent 25-50% of average electricity selling prices.

- Some submissions proposed specification of a minimum coal share in the generation mix. Coal provides diversity in the energy mix in the short term; in the medium term acts as a hedge against cartel or politically-created shortages or price spikes and, given its flexibility, can assist assimilation of greater renewables on the system; and in the longer term is a reserve in case of unforeseen circumstances. These diversity/security benefits, especially from indigenous coal, have to be weighed against coal's greater environmental impacts. Some submissions recognised, that to achieve environmental gains, the long-term average utilisation of coal-fired capacity would have to fall. The environmental impacts could be reduced by development of cleaner coal and advanced technologies – see below.
- Further deep mine closures, and falling opencast output, could reduce UK coal production below 15 Mt/yr. by 2005 and some 10 Mt/yr. in 2010-20. If the UK coal industry falls below a certain size (perhaps its current size) it could be unsustainable. Some advocates recommended guaranteed internal EU markets for indigenous coal, necessary to encourage investment in new mines. But one submission argued that, in general, Government intervention in price negotiation is inappropriate. The short-term subsidy to the coal industry should not be repeated. Another proposed that the Government could fund the capital costs of new mines, leasing them to operators. Other submissions doubt whether the economic case for new UK deep mines is viable, even though the UK has the lowest cost coal in the EU. UK mines pay a royalty on coal production. This should be reconsidered.
- There is scope to expand opencast output in the event of supply constraints. But some submissions said current planning guidelines on opencast coal mining are too weak to protect the environment and local communities; and that the Review should restrict the importance of opencast coal. Others took a different view, pointing to the short- and long-term flexibility derived from opencast mining.
- Scope exists for thermal efficiency improvements (e.g. upgrading turbine efficiency, leading to emission reductions). Cleaner coal technologies could assist to meet UK requirements and to increase exports of plant and technology. An expansion of FGD capacity, given higher gas prices and lower FGD capital costs, could permit a higher level of future coal burn. Other options are co-firing with biomass, gas ('gas reburn') and waste. Investment in new, cleaner coal technologies is also essential in the UK and overseas. Consultation on UK cleaner coal demonstration plant is in progress; the Review should not reach firm conclusions before this consultation is concluded. A Clean Coal Obligation would assist the prospects for new cleaner coal-fired plant. One submission suggested the cleaner coal technology programme should be re-focussed upon CO<sub>2</sub> removal and storage.
- There is currently no systematic assessment of remaining UK coal resources. The Coal Authority could be enabled to perform this function. Without care, the planning system might sterilise long-term access to known coal reserves.

- The UK has extensive reserves of coal that are unlikely to be worked by conventional mining methods. This potential energy resource may be accessed by other techniques (e.g. coal bed and coal mine methane extraction and underground coal gasification). Coalmine methane releases 6.3 Mt/yr. of CO<sub>2</sub> equivalent. If eligible for the Renewables Obligation, or other support, much of this could be captured for heat/power generation. Coal could also contribute to the longer-term mix via SNG, hydrogen and medium calorific gas, and liquefaction - possibly at 'energy complexes' producing chemicals, electricity and heat. Successful demonstration of carbon sequestration could transform coal's prospects. Other submissions were more hesitant about the prospects for sequestration (see section B.14).

## **B. 5. Electricity<sup>7</sup>**

- The largest contribution to the UK's environmental performance since 1990 has been made by the electricity sector (lower coal, higher gas use and higher nuclear output). On present plans, the sector cannot deliver this scale of emissions reductions in future: indeed emissions will rise if gas replaces retired nuclear plants. For the future, many submissions recognised that a considerable expansion in low/zero carbon generation is required. But, as summarised in sections B.6 and B.7 below, there was a very stark division over the advisability, cost, public acceptability and robustness of the renewables and nuclear routes.
- Electrical applications are ubiquitous and most are vital in modern economies: perhaps within a fairly wide margin, security is more important than cost. A significant reduction in reliability would soon cause wide public debate and recrimination. But absolute security of any system cannot be guaranteed, either by the market or Government intervention.
- Liberalisation has brought many benefits, including lower prices to consumers, by 'sweating' assets. It is not considered valid by some to assume that regulatory priorities and approaches that worked reasonably well in the 1990s are still appropriate for the changed circumstances of the next 10 years, perhaps even more so given the initial priorities set out for this Review.
- The regulatory regime is causing what many judge to be inadequate maintenance and reinforcement of distribution and transmission infrastructure. The regime needs to provide adequate incentives for investment in new capacity in these areas, especially to meet peak demands reliably, to anticipate significant housing growth in some regions, and to permit distribution systems to become active (to absorb embedded generation). Significant expansion of embedded generation will require a radical re-appraisal of network regulation, as it will change the design and operation of such networks. There is a difference of view as to whether an explicit capacity mechanism is needed in a revised NETA (as earlier with the Pool). Some said the position must be monitored carefully.
- Following NETA reforms, current electricity prices are low and acting as a deterrent to new investment in most types of generating plant and in FGD at coal plants. High gas prices have deterred investment in new CCGT plant, even where consents have been granted. But tightening capacity margins will cause prices to rise making new investment in some generation (including CCGT plant and wind) more attractive.
- A significant move away from large power stations feeding bulk transmission systems towards smaller, sometimes intermittent, localised ('embedded') power (and heat) plant could have

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<sup>7</sup> Clearly many electricity and gas companies are now integrated utilities. The distinction is made here to ease presentation.

profound impacts on energy transmission and distribution facilities. (See section B.6). The transmission and distribution system will remain a significant and efficient enabler of both security of supply and of fuel diversity. As but one example, the submission from one large power company said wind power (increasingly offshore) can expand at an average rate of 1 GW/yr. of installed capacity from now to 2020. (Allowing for intermittency, 1 GW is equivalent to about 1% of current UK electricity demand).

- But this would require changes in regulation, management practices, real-time balancing, electronic power control devices and novel net metering. A priority is therefore to agree on the future role of networks.
- Increased use of indigenous gas has brought the gas and electricity sectors closely together. Interdependence is now considerable as both gas (effectively) and electricity (unlike coal) are delivered 'just in time'. Flexible generating plant (including coal and pumped storage) will be needed to smooth output. Measures to increase demand side management flexibility (to interrupt non-essential loads and flatten peaks) should be re-examined by the industry, regulators and Government.
- Proposed capacity auctions in gas, and transmission access and losses proposals in electricity, are causing some widespread concern. Regulation can exert profound influence - as NETA has already on the prospects for CHP and embedded generation (discussed in section B.3). On the contrary lack of regulation may hinder system integrity. One continuing concern is that owners of power stations only have to give NGC 6 months' notice of intended plant closure and no notice of plant 'mothballing'.
- Many submissions said that EU electricity (and gas) market liberalisation should be accelerated. One submission stated that an open market for capacity in the UK/French electricity connector would be a very welcome development. Others said that access to the Scottish wholesale electricity market should be improved; that the BETTA programme should be implemented; further steps taken to break up the Scottish duopoly; and that greater competition should be introduced in the Northern Ireland electricity market.
- It is judged essential that a dependable, carbon-free base load supply of electricity is part of the future UK energy mix. Some submissions considered that gas should still be considered as a 'premium' fuel, and its role curbed in large-scale power generation (not CHP). A continued 'dash for gas' would leave the UK increasingly dependent upon imported gas. Some 'electric' companies believe low-carbon options are a viable alternative to nuclear generation. Others consider a nuclear contribution will be important. There is also broad support from the electricity sector for the Renewables Obligation.

## **B. 6. New and Renewable Sources**

- Advocates said enhanced diversity and security of supply could be achieved through increased use of renewables to provide CO<sub>2</sub> emission free energy in electricity, heat and transport markets. Many submissions associated renewables only/primarily with power generation. But a wider canvas is required over the period to 2050, perhaps especially as regards transport fuels.
- Some said the definition of renewables should be widened (e.g. to include methane from coalmines, as now for methane from landfill sites). Municipal solid waste (MSW) faces major planning and consents difficulties in the UK. MSW is also largely excluded from the Renewables Obligation. Other submissions criticised energy from waste, opposed incineration and stated

existing MSW plants should not be classed as 'renewable'. The prime focus must be upon the waste hierarchy of minimisation, re-use and recycling.

- Taken together, renewables add up to a robust package - including geographically dispersed sources, some that can provide firm power and some that can be locally embedded close to points of use and using local sources. Government policy to support large-scale testing of renewable energy technologies should be strengthened; but not restricted to renewable electricity (e.g. heat and transport biofuels). A long-term goal in some submissions is a fully renewable energy system, with ambitious intermediate targets for 2020, 2030 etc. Some wanted more ambitious targets for renewables in the overall energy and electricity mix – e.g. a higher (20%) target for renewable-based electricity by 2010; or a 2%/yr. increase in the Renewables Obligation for some sustained period after 2010. Indicative intermediate targets should be set in the Review.
- Some argued the environmental benefits of renewables are self-evident. But others said this is not the case. Renewables do indeed have an 'environmental footprint' - such as land use for generation plants and power lines, energy use in construction and, for some, difficulties in safe treatment and disposal of wastes on scrapping.
- Existing decision-making tools, laws, regulations and implementation processes have become accustomed to - and have sometimes been shaped by - the requirements of large-scale fossil technologies and nuclear power. Many believe these will require modification to avoid unnecessary impediments to deployment of renewables (e.g. NETA, access pricing, distribution charges, structure plans and planning processes). Subject to planning consents, many renewables benefit from short lead times (<12 months) and thus add to flexibility compared with long lead time plant.
- But others argued that the blind faith in the capacity of renewables to expand effortlessly is misplaced. Failure to support such technologies in the past mean that few are yet judged technologically mature and assessments of their realistic longer-term potential are somewhat rudimentary. Renewable technologies are not seen by some to be capable of contributing on an adequate scale to displace other options, such as nuclear power.
- Evolving policy will be informed by accumulating UK and international economic and technical performance data of a kind not yet available for most such technologies. Whilst deployment of renewable technologies should be encouraged, as part of a low-carbon energy mix, several submissions said their contribution - at least in the short-medium term - should not be exaggerated.
- Despite the Government's indicative target for renewables (10% of UK electricity production by 2010), and the proposed introduction in early 2002 of the Renewables Obligation (RO), there is some doubt whether this can be achieved. Many said NETA has not helped. But one submission thought Ofgem was correct not to change the rules for NETA; and that a balancing market would eventually emerge as the most efficient mechanism for handling such issues arising from large-scale use of renewables for power generation. Some thought the RO should be banded, to assist less mature technologies. Others opposed such a move. Some argued, at least for a transition period, that renewables need an electricity 'Pool' of their own (separate from NETA, with distinct rules of engagement for balancing and settlement) until the transmission/distribution systems and regulatory regime are re-configured.
- Some said that a modern electrical power system cannot operate reliably, and maintain supply quality, with more than a limited amount (c. 20%) of directly connected, randomly intermittent power (e.g. from wind, tidal stream, wave or solar plants). The trend towards embedded

generation should not jeopardise the integrity of grids. Electricity companies generally took a different view about the principle of integration of embedded and intermittent sources but pointed to the need to make distribution systems 'active'. Some submissions said intermittency should not be confused with unreliability: some intermittent sources are predictable, others can be forecast with some precision. Others said the output of some renewables was vulnerable to adverse weather conditions and that the impacts of realistic 'fault' cases (e.g. prolonged calm or stormy weather) should be examined. Greater storage and extra spinning reserve would be required if the renewable share rose further, depending upon the quantity of other flexible plant on the system. One suggestion is a well-resourced, independent, national technical centre, to provide expert advice and evidence. Others suggested 'micro power' zones as pilot schemes to evaluate the system effects of large concentrations of various small-scale technologies. (JHC note: Despite much literature on this subject, it does not reach a wide audience. The Review process could do much of value to dispel ignorance and confusion on this increasingly important subject; and to identify the key policy and technical issues - e.g. on the active management of local distribution networks; the implications for transmission grids; integration with flexible, load following, plant; the scope for greater demand side management of electrical loads, especially with better metering; storage options; and who might be responsible for ensuring any targets for embedded generation are met).

- Large-scale deployment of some renewables (e.g. offshore wind, wave and tidal energy plants) with a large generating potential will require substantial grid reinforcement. For reasons of location, this applies particularly in Scotland and to cross-border, north-south grids. Others argued that renewable technologies might avoid distribution losses and the need for transmission/distribution system reinforcement. A renewables resource review and a network study are in progress in Scotland. It is not clear how/by whom such reinforcements would be funded. One submission proposed an obligation on the grid operators to fund or part-fund grid extension to offshore generating plant.
- Some renewables provide intermittent supplies requiring expensive buffers and back-up plant. Coal-fired generating plant was seen to offer the flexibility necessary to balance the system. For the medium/longer term some suggested hydrogen as a storage medium.
- Some said the Government should favour renewables (and CHP) in power station consent decisions. Others stated revised planning guidance should be issued to local authorities on deploying renewables, with a presumption in favour of consent, possibly in the context of regional energy strategies. Some said measures are necessary to overcome local resistance to renewables development at the planning stage. Requiring a proportion of local energy demand to be met from local sources might ease planning processes and raise public consciousness. Given planning problems onshore, and the sheer scale of offshore resources, wave power and offshore wind were strongly advocated by many. However, one submission stressed that the rationale of the planning process was to prevent a 'free for all' approach and objected strongly to the planning process being perceived as a barrier to be overcome: the planning process is not an entirely capricious one. Any large-scale deployment of wind power in sensitive areas did indeed threaten devastating impacts on landscapes. As elsewhere in the energy sector, renewable energy developments must be undertaken sensitively.
- Domestic and community scale renewables (e.g. biomass, solar water heating and PV) should be encouraged and could be important in rural areas. Legal, regulatory and market barriers should be reviewed. The PIU was asked to evaluate the scale of PV power generation likely

from a large-scale deployment of PV on building roofs. Others wish the toxic waste problems associated with PV to be explored fully.

- The role of new and renewable technologies in tackling fuel poverty should be explored, especially in rural areas remote from piped mains gas supplies. Energy service companies in the renewable field offer a route to faster market deployment. As yet there is little apparent customer interest in 'green' tariffs.
- The EU should develop an integrated energy market for renewable energy. Reform of agricultural policy should encourage energy crops. Energy crops, agricultural and forestry wastes and biofuels are important for heat and transport markets. The latter will require encouragement by sustained and adequate differentials in road fuel duty rates. Some advocated a specific target: e.g. 10% of UK transport fuels from renewable sources by 2010. But the oil refining and downstream oil-marketing sector is opposed to the mandated introduction of biofuels.
- Assessments of the role of hydrogen as a vector vary considerably. Some anticipate the emergence of a significant and pervasive hydrogen economy within 50 years; others a key role for hydrogen primarily in the transport sector, and on a shorter time scale - c. 10-20 years. But fuel cells are not yet seen by most to be technically and commercially viable. One submission proposed offshore wind power generation combined with production of hydrogen, using the (then) life-expired oil and gas platform and pipeline infrastructure. Policy/technical expertise on hydrogen should be reinforced; and a hydrogen task force established.

## **B. 7. Nuclear Power**

- Many said nuclear power has significant environmental, price stability, diversity and security of supply benefits. Uranium is plentiful, available from numerous politically stable sources, and can be stored easily. Once plants are built, nuclear costs are largely fixed over plant lifetimes. The UK, EU and OECD civil nuclear track record in safety is impressive.
- Nuclear is the only large-scale generation option that does not emit greenhouse gases. Some 50 Mt of CO<sub>2</sub> emissions are avoided (based on current fossil plant mix) by present nuclear generation, equivalent to those produced by nearly half of all UK road vehicles.
- The UK should continue to source some 25% of electricity from nuclear and, at least in the medium term to 2020, 'replace nuclear with nuclear' to ensure base load supplies, utilising existing nuclear sites (and grid connections) for new capacity. This suggests commissioning some 10 stations of 1000-1200 MW, of standardised design, between 2010 and 2025 at a total cost of some £10 bn.
- All client organisations for past UK nuclear build were in the public sector. The commercial performance of civil reactors has improved significantly following exposure to market disciplines.
- There is an uneven 'playing field' between supply options. Advocates stated that only nuclear takes full account of its long-term environmental impacts in its cost/pricing mechanisms (though those opposed to nuclear argued that the industry does not yet bear its full insurance liabilities, unlike other options, and should be made to do so to ensure a fully level 'playing field').
- Some progress has been made in addressing decommissioning challenges, but perhaps less in resolving waste disposal. An independent Decommissioning Agency is proposed. Some claim long-term waste disposal poses no scientific or technological challenges and can be addressed by decisive political decisions. The identification of suitable, dry, geological structures is a priority. Reprocessing of spent fuel should remain an option. Others disagree strongly (see below). Whilst the RCEP and numerous PIU Review submissions stated that waste issues

should be resolved before new plant ordering, most (but not all) advocates of nuclear power disagree and say waste should not be a ‘show-stopping’ issue for the Review.

- Given long lead times, new and/or replacement reactor build issues must be addressed in the near term. For nuclear to become an option in the future energy mix, new plant must be built to acceptable costs/prices - with specific capital costs/kW some 30-50% lower than for Sizewell B.
- At current post-NETA electricity prices (£18-20/MWh), a significant economic gap exists in the new nuclear plant ‘base case’ – even excluding ‘first of a kind’ costs. The economic viability of new nuclear plant requires electricity-selling prices of £25-30/MWh. Commercial viability of a new build programme requires a long-term premium, reflecting nuclear’s environmental and other benefits. Instruments proposed to close the economic gap include: a ‘carbon free’ obligation; extending the scope of the Renewables Obligation; exempting nuclear from the CCL; allowing nuclear to participate fully in emissions trading; a carbon tax; recovery of allowable costs by nuclear generators via a regulated rate of return; and spent fuel contracts based on the US fixed price arrangements (\$1/MWh produced). Investors would also require confidence in the long-term stability of the chosen support arrangements. Financing arrangements for new build will depend strongly on acceptable risk sharing/risk management models.
- Whilst UK nuclear manufacturing capacity has declined, the reactor equipment market is now an international one dominated by a few, large vendors. UK operators (BE) have accumulated much valuable experience of operating different reactor types under different licensing and regulatory regimes. New reactors offer simplified modular design, shorter construction times, lower capital and operating costs, improved (passive) safety features, higher lifetime plant availability, longer plant lifetimes (up to 50-60 years) and reduced waste volumes. Their fuel cycles could also assist in disposing of plutonium and HEU deriving from civilian and military use of nuclear. UK companies have much experience and a leading global role in fuel enrichment, reprocessing and decommissioning, creating employment and exports.
- Safety and licensing work necessary for approval of a new reactor design should be predictable, modest and manageable. A more assured, ‘one-step’ consents and licensing process is now required, addressing all issues of principle prior to project commencement. UK regulatory bodies should be consistent (see section B.12). A new reactor design should be able to secure ‘generic approval’, and local planning processes should focus on site-specific, local issues. International harmonisation of safety and regulatory requirements would be beneficial. The UK should not, as in the past, develop a distinctive reactor design.
- Irrespective of new build, maintenance of a skills base is crucial for plant operations, safety and regulatory functions, nuclear waste management and decommissioning in the UK and overseas. Maintaining the nuclear option requires positive action in the short term. One reason is ageing and attrition of skilled nuclear project management and regulatory staff. New build would assist in recruiting and retaining new staff.
- In the past, the industry had an unfortunate image of secrecy. But some argue anti-nuclear campaigners have distorted public opinion. The industry should expand efforts to communicate, openly and honestly, with the public. Perhaps the most fundamental issue for the industry (and Government) is finding an appropriate framework within which to engage in open and transparent debate with the public on nuclear issues, and within the wider context of energy, environment and supply security. One suggestion is for a Government-sponsored, broadly based Stakeholder Review Panel; and for ‘front end consultation’ to permit public involvement in framing a review of future nuclear policy.

- Most - but not all - commentators judge fast reactors, fusion and other advanced nuclear systems (e.g. thorium) to be beyond the scope of the Review, and unlikely to contribute significant output before 2050. There is disagreement about the appropriate scale of current and future fusion R&D. Advocates of fusion pointed to the key role of JET, the need for continued R&D, and also the ‘spin-offs’ deriving from fusion research (e.g. in plasma physics). Several submissions argued for commitment to a demonstration-scale fusion plant (in the UK or abroad); and some for early UK investment in a spherical (rather than toroidal) geometry design at a projected construction cost of <\$1bn with the aim of commercialisation in some 20 years. One argued that, though opposition to fission was growing, there is broader support for fusion. Another argued for an information programme about fusion for decision-makers and the public.
- Government action is required now. Postponement of decisions will impair, if not preclude, nuclear from delivering its potential benefits. Many submissions from companies and individuals supported the continued use of nuclear power on environmental, diversity and security grounds as a key element in base load generation (and, in some cases, for hydrogen production). It is argued that, without a contribution from nuclear power, the UK cannot maintain or reduce its carbon emission limits. Not all electricity companies share this view.
- But very many other submissions expressed strong opposition to any expansion of nuclear power, primarily on grounds of cost, health, safety and radioactive discharges to air and water. Many of these argued that, although nuclear power could reduce CO<sub>2</sub> emissions, it had other significant environmental impacts that offset this advantage. Several mentioned heightened terrorist and ‘rogue’ government threats to nuclear facilities. Some argued for immediate cessation of reprocessing and no commissioning of the MOX plant at Sellafield. Others pointed to unwelcome military linkages, secrecy, falsification of safety records, human error and project ‘appraisal optimism’ in the past; and the risks of series ordering of new reactor designs (AP600, AP1000, Candu and PBMR) with no international experience of full-scale construction or commercial operation. Others expressed concern about the opportunity costs of further public expenditure on nuclear power, preferring such resources to be committed to energy efficiency and renewables. Others stated that the nuclear industry had benefited from strong Government financial and political support for 50+ years. As a mature technology, nuclear power should not require, or receive, further assistance. Rather such support should now be re-directed to a more ambitious energy efficiency, CHP and renewable energy strategy. Several asked for renewable technologies to be given a chance to prove their potential. Should this not materialise on a sufficient scale and at acceptable costs, then they were prepared to re-consider the case for a new nuclear programme. A key requirement for such a ‘wait and see’ strategy is retaining sufficient expertise to be an intelligent customer and user. But many others stated that they were opposed to nuclear on fundamental grounds.

## **B. 8. Oil and Gas**

- Oil and gas are seen as likely to remain the most important energy sources for the UK over the next 20-30 years, possibly much longer.
- The UKCS is mature, perhaps middle aged, but judged by most to be in terminal decline in the longer term. Very considerable reserves remain to be exploited. Maximising exploitation of this secure indigenous supply is essential, requiring new technology but also a favourable fiscal regime. Many supported the DTI’s PILOT initiative for offshore technology. High marginal tax rates, especially on ‘brown field’ sites, are inhibiting development. A primary requirement of UK

energy policy should be that the fiscal and regulatory regime continues to keep the UKCS competitive, on an international basis, for new large-scale investment. Some submissions recommended that Ofgem should be responsible for economic regulation of offshore gas producers and pipelines. Some proposed re-cycling of 'fallow' offshore acreage to more committed and enthusiastic operators; and pressed for more open disclosure of the terms/tariffs for access to the existing offshore pipeline infrastructure.

- Global oil and gas reserves are undoubtedly extensive; but there is disagreement about anticipated production and reserve levels. Oil companies anticipate further technological change and higher oil recovery factors. There is also disagreement about the geopolitical risks and physical security of oil and gas supplies from particular regions and countries. Oil and gas companies tend to adopt a more 'relaxed' (though certainly not complacent) view; whilst some independent analysts and commentators are more cautious.
- Some submissions raised the issue of the overall economic costs of possible future heavy dependence upon oil and gas imports. But one submission stated that, had the UK imported *all* of its oil and gas needs in 2000, this would have represented only some 1.9% of GDP - a figure judged unlikely to rise in future.
- One key issue raised in several submissions is the capability of the gas transmission system - in terms of spare peak and total capacity, and response time for rapid changes in demand (especially power generation). Another is the adequacy of gas storage (and of the regulatory regime to incentivise and oversee it); and also the number/capacity of gas transmission entry points. Provision of additional gas storage facilities is seen as an important option for the UK's gas balance and for future security. There is a case for specific monitoring of gas industry-wide security levels. Some said storage is not an issue, but access to peak gas supplies is.
- Of particular concern is the impact of recent and proposed auction methods in increasing uncertainty about access to present and future onshore entry and gas transport capacity. Many submissions expressed the view that capacity auctions are not the right mechanism to ensure sufficient gas transportation capacity. Under the present regulatory regime it is judged that the risks to the UK economy of under-investment in the national transmission system far outweigh the risks of over-investment. Another major concern is the vexed issue of aligning gas and electricity balancing systems, especially any move to hourly (or even shorter) gas market balancing.
- To obtain imported fuel, especially gas, UK gas and power companies will become increasingly reliant on the effective operation of networks and markets in continental Europe and beyond and thus on other regulatory regimes. Satisfactory cross-border trading arrangements must be agreed. There is support for recent EU initiatives to encourage greater competition in sales of Norwegian gas. The requirement for imported winter/peak gas is expected to grow faster as the more flexible, 'high swing' existing UKCS fields are replaced by less flexible fields. Greater gas interconnectivity with continental Europe is required - through increasing the reverse flow capacity of the existing interconnector and, some argued, construction of a second interconnector.
- Continuing opposition to gas market liberalisation in some EU countries could undermine assumptions about the availability, timing and cost of gas imports to the UK. The UK should press for early liberalisation in the EU. Liberalisation must be undertaken without endangering EU supply security. Some thought a mix of short-, medium- and long-term supply contracts should be encouraged. Even with full liberalisation, some doubt whether there will be significant

gas to gas competition in the continental EU market; and that oil indexation will still play an important role in determining gas prices there (and thus here).

- Other points made in submissions included the following: the oil industry is committed to development of cleaner transport fuels and to reducing its own environmental ‘footprint’ in on- and off-shore operations (e.g. gas flaring, discharges to sea, and refinery operations); the scope for local injection of gaseous fuel into the gas grid should be explored (e.g. for biogas digester and landfill methane); the UK should not ignore the potential contribution of Orimulsion in the power generation fuel mix; and exploration along national median lines requires more flexible and co-operative arrangements between the countries involved.

## **B. 9. Diversity, Endurance, Flexibility, Redundancy and Security of Supply**

- There is considerable ambiguity in the use of these and similar terms (e.g. adaptability, ‘optionality’ and resilience). They may all be considered as dimensions of, or means of securing, supply security. Their application to the energy system and to the provision ultimately of energy services should be rigorously defined and become more widely understood. Neither are all the options for enhancing security on the supply side, or only on the electricity and gas supply sides. Lower cost, advanced metering and signalling technologies may well permit more effective utilisation of the demand side (e.g. exploiting the thermal inertia in cooling and refrigeration loads). Neither should perspectives be dominated by the narrowly technical. For example, from a consumer perspective, for a domestic consumer seeking to wash clothes a breakdown in a washing machine also represents failure to supply an essential service.
- It is doubted by most (but not all) that energy markets, left to themselves, will deliver outcomes consistent with the Government’s energy policy objectives. There are also potential conflicts between the Government’s wider policy goals and the objectives of independent regulators, especially in network regulation. Short-run marginal cost pricing is not perceived to be consistent with supply security. There is considerable concern that the form and style of price control adopted by gas and electricity regulation have exacerbated investment in distribution and transmission capacity. Methods of rewarding capacity are seen to be essential by many.
- In particular, markets may not be able to deliver security of supply (or environmental) objectives, achieve the right balance between these and competitive prices, and reconcile the conflicts which can exist. This is because the costs of failure to meet security of supply (or environmental) objectives are not fully borne by suppliers. The risks to suppliers of interruptions in supply over long periods are much less than to the country as a whole.
- The Government must specify the level of risk and vulnerability that is to be tolerated in the energy system - especially electricity and gas; and, effectively, the ‘insurance premium’ costs to be borne. This was seen of particular importance for transmission security. The responsibility for the detailed implementation and monitoring of quality of supply must be with Government and/or its regulatory agencies. The difficulty is *how* to reconfigure the market to take proper account of longer-term factors and, if judged necessary, to override shorter-term market forces. From evidence submitted to the Review such considerations are rather narrowly focused upon power generation. They apply with similar importance to the heat and transport markets. True security might mean no significant ‘common mode’ failure risk. Flexibility is the only way to plan for the unexpected. Policy should thus place a high value on flexibility and adaptability.
- There are very marked differences of view about the imminence and scale of commodity energy scarcity from indigenous and global sources; and thus about the need for, and scale and urgency

of, suitable responses. Some stated that an inherent characteristic of a global economy is free trade, comparative advantage and exchange. In this context, import dependence in energy should be of no greater concern than for other vital goods. One submission was concerned about *any* external reliance on some/all energy supplies; and argued that a good way to increase security was for the UK to be self-sufficient in energy. This view is not widely shared, given the cost implications of such autarky.

- In future, more coal, electricity, gas and oil will be traded across national frontiers than was true in the past. The role of interconnectors will increase. Diplomacy and inter-governmental co-operation are essential.
- Security is not limited to the actual, or perceived, adequacy of energy commodities or generating capacity. Network interdependencies are still poorly understood. A key feature of the submissions to this Review is the urgent need to identify both (i) 'pinch points' and (ii) the scope for flexibility. Many submissions are concerned that the 1990s had witnessed pressure on 'margins' of all kinds (profits, skilled staff, maintenance capabilities, R&D, spare capacity, 'sweating' of assets and reduced investment in distribution and transmission and a more pervasive move to 'just in time' practices across the economy, including fuel deliveries and stock levels at points of use).
- Qualitative changes have also occurred in energy markets. Fewer final consumers now use coal or oil (outside transport) stocked at point of use. Increased use of electricity and gas means that final consumers are now dependent upon decisions taken by others. Quality as well as price should be given higher priority in consumers' choice of supplier and in regulation. In this sense quality reflects diversity, endurance, flexibility, back-up etc.
- The energy system (demand and supply) is characterised by large investment, long life assets and long lead times for capital stock rotation. Measured, rather than revolutionary, change is inevitable. A long-term perspective is thus essential.
- Key requirements for diversity and security include: a diverse mix of primary energy sources and technologies; geographic diversity of such sources; and the ability to store and stockpile strategic national reserves (especially uranium, coal, oil and gas). Some submissions stated UK gas storage capacity is lower than that in much of the EU and should be increased. Others said that coal is inherently easy to store at power stations.
- At present, the UK power generation plant mix is balanced, primarily between coal, gas and nuclear power. Recent DTI projections suggest that, by 2020, gas might provide 70% of UK electricity - increasingly based on imported gas supplies. Numerous submissions suggested that the future size of the UK coal industry and/or coal-fired generating capacity might need to be reviewed to maintain diversity for longer than was earlier foreseen.
- Suggested models for a 'balanced energy policy' include: (i) 30% gas, 30% coal, 30% nuclear and 10% renewable; (ii) criteria such as: a limit on any one fuel source of 40% of the total mix; 50+% from indigenous or reliable sources; 50% from carbon free sources; (iii) 10-20% renewable; 30-35% gas; 30-35% nuclear; and 15-20% coal. Time scales and target dates were not always given for these alternative mixes. But many others oppose such an approach as it confuses means and ends; could impose higher costs; and could compromise diversity and security by prematurely eliminating some longer-term options.
- Other points in submissions included: small-scale electricity generation at community and household level should be encouraged to increase diversity and local security; and multi-fuelled power plant and industrial boilers provide some diversity and hence security.

- Some submissions expressed concern about the concentration of supplier power in energy markets; a few others about the extent of foreign ownership in the sector.

## **B. 10. Environmental, Health and Safety Issues**

- Numerous submissions welcomed the long time horizon adopted for the Review. They also said the Review should be placed firmly within a context of sustainable development – and not just climate change, important though this issue is. Most evidence explicitly/implicitly accepts the scientific consensus on climate change emerging from the IPCC process. But some cautioned the need for better scientific understanding before costly (as opposed to ‘win-win’ precautionary) response strategies are developed.
- Much emphasis has been placed on *mitigation*. But there is also an imperative - especially in the energy system - to plan for *adaptation* to the impacts of climate change (e.g. flooding, sea level rise, access to water resources, the built environment and heat/cooling demand, storms and other extreme climatic events etc.).
- Whilst many recognised the CO<sub>2</sub> reduction potential of nuclear power, many others argued that nuclear imposed other known and unknown environmental burdens over very long time horizons. Thus they preferred development of renewable energy technologies.
- One submission expressed concern that the focus on climate change might distract attention from the vital focus upon a secure energy supply.
- All energy production imposes environmental impacts: no usable energy or power source is environmentally benign. These impacts embrace land use, noise, visual intrusion, wastes, emissions etc. Perceptions can be as important as reality. There is no ready calculus to compare these impacts; although some submissions referred to the value of the EU-funded Externe programme. A robust methodology for quantifying the environmental (and health, see below) impacts of energy policy options is essential. It would also assist in the cost-benefit appraisal of some policy and regulatory changes.
- All energy systems carry substantial health and safety risks to staff and the public. Whilst numerous submissions - usually from those opposing new nuclear plants but, in some cases, waste incinerators - mentioned health and safety issues, these were not a dominant feature. A few mentioned the deleterious health impacts of transport and fossil fuel combustion. (Note by JHC: the health and safety dimensions require development and more explicit attention during/after the Review).

## **B. 11. Institutional and Policy Development Issues**

- Appropriate institutional arrangements are needed to achieve the required shifts in attitudes, behaviour and energy use. Even more important is common purpose and collaboration, within the UK and elsewhere.
- It seems irrational to some that energy policy making is presently based in a department whose duties appear biased towards sponsoring the interests of producers and thus imbuing policy options with a supply-side emphasis. Whichever department has lead responsibility, its staff resource needs to be capable and well informed with suitable models, information gathering and research resources. Clarity and consistency of policy thinking is at a premium.
- Much more effective integration of government policy is essential, especially (i) between energy, environment and transport; and (ii) at national, regional and local levels. Government and other

organisations (regulators, energy and equipment suppliers, fuel poverty and energy advice agencies, and professional bodies) should be engaged in rationalisation of agencies, policy directorates, initiatives and schemes, institutions and advice provision. Fewer organisations and larger schemes would assist. The ‘paper chase’ must be greatly simplified on both demand and supply sides to accelerate momentum.

- Creation of yet further, new, institutional arrangements (e.g. a Royal Commission, a Strategic Energy Authority, or a Sustainable Development Agency, each favoured by some) are judged secondary to the above. One proposal is for a low-carbon policy unit in the Cabinet Office, supporting a low-carbon Ministerial committee, and supported by low-carbon policy networks and a low-carbon Agency.
- Some said devolution of energy functions (within UK nations, and at regional/local level) is to be encouraged. Over time, the development of differing approaches will provide alternative models of best/worst practice. Such devolution should encourage local collaboration, but it should avoid yet further proliferation of agencies and institutions. The role of local authorities should be enhanced and constraints on their role removed. The energy/environment capability and expertise of local authorities should be increased.
- Innovation in policy making, especially developing new frameworks of analysis and policy development/implementation, is as important as technological innovation. International experience should be monitored and best practice adapted and implemented.
- There is a welcome for the Government’s attempt to improve the general level of understanding on longer-term energy issues by quantifying risks and benefits in a more open and mature manner. Key issues are what comes next, especially in terms of the framework and its regular re-appraisal; and the importance of properly conducted public consultation. Following completion of the Review there should be adequate time for public and parliamentary consultation upon it, perhaps moving to Green/White Papers. The importance of wide public and party political support for a long-term shift in policy direction was stressed. Again, caution is emphasised about ‘bold’ unilateral strategies.

## **B. 12. Economic/Market and Environmental Regulation**

- Consistent and stable regulation is important for long-term investment. Some judge it paradoxical that the de-regulated, liberalised market requires re-regulation to make it work and to steer it in desired directions.
- The current UK regulatory regime has, to date, focused very heavily on price control and may be damaging investment (i.e. it takes a short-term view). Some thought Ofgem should incorporate environmental externalities within its decision-making processes; internalise its Environmental Action Plan; and make decisions consistent with Government environmental objectives.
- Others argued for yet closer working relationships between economic, environmental and safety regulators, particularly in the light of the complex issues arising during this Review. The three main regulators of the nuclear industry (Ofgem, EA/SEPA and HSE/NII) often impose incongruent and, occasionally, conflicting demands - jeopardising new investment. Similar points were made in relation to other industries.
- Some said regulatory reviews should commence with a competent risk assessment but this proposal has faced opposition from regulators. Others said regulators should undertake cost-benefit and regulatory impact assessments to assess how proposed regulatory changes might

help achieve specified Government objectives for the environment, supply security etc. For example, some submissions argued that the potential negative impacts of NETA on renewables and CHP were clear to many before NETA was implemented. NETA must now be re-examined in a ‘joined up’ way. Regulation must facilitate, and not impede, necessary evolution.

- Some said that Ofgem and the Government should review how long-term electricity contracts, required for base-load generation, can be put in place. Provision of sufficient market and regulatory stability is seen to be essential to justify long-term investments, especially in power generation. Some argued that the present regulatory system is not designed to deliver non-marginal changes, such as might be required to facilitate a major shift to embedded generation. Some said the Government should thus take a lead role in encouraging embedded generation; ensuring that this is not frustrated by Ofgem; and ensuring greater transparency in RECs’ plans for system reinforcement. Similar points relating to the gas industry (e.g. concern over auctions and incentives for transmission capacity) are recorded earlier, but not repeated here.

### **B. 13. Policy Implements**

- Some said that the market should be seen as a human construct, not a force of nature: we can shape it as we wish. Virtually all submissions recognised that the market cannot necessarily be relied upon to meet specific requirements, relating to the environment, diversity and security of supply. The Government must, therefore, set the broad framework within which the market operates. Mechanisms to evaluate costs and benefits of policy and regulatory changes are seen as essential.
- Pragmatism and uncertainty require the use of a range of policy instruments. These include: taxes, tax credits, subsidies, licences, planning regulations, environmental, health and safety regulations, market conduct regulations, minimum performance standards, trading arrangements (including for carbon), R&D support and education and information programmes coupled with effective consultation. Greenhouse gas emission reporting should be mandatory for most non-domestic users; fuels bills and perhaps airline tickets should identify emissions to increase awareness.
- Many said the use of price increases to influence domestic sector demand is not currently judged politically feasible or socially acceptable (given their regressive effects, especially upon those in fuel poverty). Current initiatives to ameliorate the position mean that price-based messages might be used in the longer-term future. Indeed, some argued that energy taxes should rise over the next decade; and that firms and households should be given a clear understanding of intent. Others argued strongly against the unilateral imposition of higher taxation in the UK given its impacts on competitiveness and fuel poverty.
- In tackling emissions, carbon taxation is preferable to energy taxation. But taxation should be balanced by appropriate tax incentives. Higher prices can advance environmental and security objectives. But price elasticities are low and higher prices impinge on fuel poverty and industrial competitiveness. Energy-intensive users have obvious incentives to raise efficiency and also face tight environmental regulation of processes. Domestic consumers have benefited from lower real energy prices, and lower energy taxation. Those who live in fuel poverty will always be amongst the first to be disadvantaged by higher fuel costs. If taxes cannot be raised because of fuel poverty, then incentives and other instruments are needed to stimulate energy efficiency responses. Some argued for combined use of all instruments to force the pace.

- Whilst some welcomed the CCL, others favoured a carbon tax for a variety of reasons. The CCL, an energy tax introduced on environmental grounds, taxes nuclear power. The UK's emissions trading proposals, focusing on carbon reduction, also exclude nuclear power. Burdens should be allocated more equitably. One industrial submission was concerned about cross-subsidy of domestic users by industry. Another said industry must not be seen as a soft target for higher imposts. Some argued that more CCL/carbon tax revenues should be hypothecated to support energy efficiency, renewables and R&D. Expenditure on energy efficiency measures and R&D should be greatly enhanced.
- Numerous detailed proposals for tax changes were made (e.g. the tax rebate for bio-road fuels should be the same as that for CNG and LPG) but these are not fully recorded here.

#### **B. 14. R&D and Technology**

- Privatisation has caused a significant decline in industry-financed R&D, especially on longer-term generic R&D. Government-funded R&D has also declined steeply. Several said a comprehensive energy technology strategy is required, embracing the demand and supply sides, examining support instruments, and identifying new industrial and export capabilities. The Government, industry, research councils, the EU and other partnership arrangements must focus on a portfolio to underpin strategy emerging from the Review.
- No energy option should be arbitrarily excluded, either from the energy policy review or any associated technology policy review. But the range of technologies and the types of support they require are large: so is the potential scale of funding. An energy policy strategy following this Review must define focused R&D objectives and funding arrangements as part of a coherent strategy for the UK (and EU). Premature 'picking of winners' is generally discredited as an approach, but several submissions did just this!
- Significant public support is seen as essential for a relevant UK R&D portfolio. Many proposals were made (e.g. advanced combustion systems using fossil fuels, biomass and waste for heat, power and transport, as well as new and renewable, nuclear and storage technologies). They are not fully reproduced here. The Review should consider the conclusions of the DTI review of cleaner coal technology. R&D expenditure on household energy efficiency is estimated at £1m/yr., judged a totally inadequate sum given the policy challenges now faced. Efforts to reduce 'stand-by' losses in IT and entertainment appliances should be accelerated.
- Several submissions said some foreign governments have larger-scale and more innovative programmes to support R&D, demonstration and technology deployment. Efforts should be broad-based, focus on a range of unit scale (smaller as well as larger) and markets; and include some test centres. R&D and demonstration on the integration of 'packages' of technologies are also important, e.g. wind/storage/fuel cell combinations. Long-term R&D is needed to support transitions to more geographically dispersed, small-scale generation; and away from oil-based transport.
- Government R&D programmes should be made more seamless, leading smoothly (for promising technologies) from research, development, prototype testing, engineering improvement and demonstration, and market deployment to maintain technological momentum and avoid the hiatus resulting from 'stop-go'. The huge gap between R&D and market support, which frustrates commercialisation, should be filled. Market building and stimulation, and public procurement, is emphasised by some as a means of lowering costs by providing sales volume for

low-carbon technologies. The scale and scope of the Market Transformation Programme should be considerably enhanced.

- The need for Government, EU and other bilateral/multilateral collaboration and support was emphasised. The UK could not fund all options. The need for support for full-size demonstration plants was identified in several submissions (e.g. biomass gasification cycles, some cleaner coal technologies, carbon sequestration, and the hydrogen vector infrastructure). Some said too much nuclear R&D is devoted to fusion, especially in the EU 5<sup>th</sup> Framework Programme. The UK should contribute to an international R&D programme on CO<sub>2</sub> capture and sequestration to establish technical feasibility, costs and long-term environmental impacts.
- The science and technology base requires nurturing, especially to produce cadres of well-qualified scientists and engineers and to maintain the UK's international competitiveness in global technology markets (see also the next section).

## **B. 15. Education, Training and Skills**

- A broad base of public support will be essential in the transition to a low-carbon economy. Outside informed circles, there is yet little awareness or obvious acceptance of the measures needed to achieve sustained, deep reductions in emissions. This is perhaps aggravated by public expectations of further sustained price reductions similar to those obtained over the past 5-10 years. Information provision and education at all levels is essential. Mechanisms for more effective public participation at national and local levels should be explored, drawing upon experience of such public engagement elsewhere. The issue of lowest short-term costs v. the value of longer-term investment should be addressed. Informing the public is only part of the solution: the public has a voice, and views and concerns must be taken into account.
- The Review should identify skill shortages and education and training requirements. Several submissions pointed to the downsizing (by management decision) or erosion (through retirement and retention problems) of skilled work forces; and the need to raise the quality and quantity of the current and potential scientific and technical work force. In particular, it was said that a renewables (and a new nuclear) programme could enthuse the young, increasing interest in science, engineering and technology subjects.

## **B. 16. Industrial Development and Employment**

- Nearly all industry-based submissions pointed to the significant contribution their sector makes to industrial production, GDP, exports, import substitution and employment.
- They stressed the profound significance energy policy decisions could have on current industrial activities and future design, manufacturing and sub-contracting capabilities. Large swings in policy have severe and disruptive 'multiplier' effects on plant ordering rates. From an industrial perspective, the Review should seek to provide a firm, coherent and consistent framework against which industry can plan. The Review should also bear in mind international competitiveness and not lead to unreasonable and unilateral cost/price burdens, not borne by overseas competitors.
- Considerable potential for industrial development, employment, exports and technology transfer exists in energy efficiency, nuclear fuel services, clean fossil, renewable technologies, nuclear decommissioning, waste management etc. The UK is well placed to develop a lead in offshore technologies; and to share in the growth of global demand for low carbon (efficiency and

renewable) technologies. Some submissions suggested that the UK's shipbuilding and offshore technology experience and skills could be deployed in offshore renewable energy programmes. One submission stated that the UK could have a greater impact on global emissions by developing technology for export. A contrary view was that at least some technologies (e.g. clean coal) should be developed in those markets most likely to deploy them, albeit with technical assistance.

- (JHC Note: Very few submissions were received from companies active in the key construction, appliance, equipment and travel/transport/vehicle sectors. Given their crucial role in influencing energy use and the transition to a low carbon economy their fuller engagement should be sought before the Review is finalised).

## **B. 17. Some Other Issues**

- As the Review will inevitably raise ethical, moral and inter-generational legacy issues, religious organisations should be engaged effectively in debate and policy discussion.
- Many submissions said UK strategy must not be developed in a vacuum. It will be influenced by developments elsewhere, especially market liberalisation and other initiatives now being taken in the EU and USA, and by continuing global climate change negotiations. The UK must continue to press for early and effective liberalisation of EU energy markets and reciprocity in cross-border investment, take-overs and mergers. Measures stemming from this energy policy Review should not allow continental opponents of market liberalisation to claim the UK 'experiment' has failed. In particular concerns over supply security should not be used to obstruct EU market liberalisation. Rather the Review should demonstrate how market forces can be harnessed imaginatively to secure broader environmental and security objectives at least cost.
- Numerous submissions pointed to the historical role played by the UK, during the Industrial Revolution, in shifting the world towards growing fossil fuel dependence initially based upon coal; and argued, in a new Millennium, the UK now had a role in contributing to (even leading) a decisive global shift towards a low/no carbon future.
- Several said the UK Foreign Office and Department for International Development have a wider, leadership role in international diplomacy and policy making. The UK should contribute to global sustainable development, especially in developing countries, in terms of aid programmes, education, training and technology collaboration and transfer. Indeed, given the UK's declining share of greenhouse gas emissions, this would be an important contribution to the wider global response.

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**APPENDIX 1**  
**SUMMARY LIST OF SUBMISSIONS REVIEWED**  
**(Evidence received by the author by Saturday 29 September 2001)**

This list has been categorised broadly by institution (consumer groups, energy supply industry, individuals, professional organisation, trades unions etc.) to assist in identifying the major sources of evidence by stakeholder group. The numbering of each item of evidence is as developed by the author, and does not necessarily reflect the order, or the date, of original receipt of evidence by the PIU. Several organisations stated that they intend to submit further evidence at a later date.

**Government Departments, Agencies, DTI Energy Advisory Panel & Foresight Teams**

Department of Trade and Industry (initial contribution)	Ev. 1
DTI Energy Advisory Panel (EAP) (Defining a Framework etc)	Ev. 59 (a)
EAP (Advice on RCEP's report)	Ev. 59 (b)
EAP (Note on security of supply)	Ev. 59 (c)
Energy Foresight: Energy & Natural Environment Panel	Ev. 220
Energy Foresight: UK Advanced Power Generation Taskforce	Ev. 178
Environment Agency	Ev. 265
Scottish Environmental Protection Agency	Ev. 233
Scottish Executive	Ev. 72
Scotland Office	Ev. 92

**Consumer Groups**

Consumers' Association	Ev. 77
Energywatch	Ev. 26
Major Energy Users Council (MEUC)	Ev. 12

**Energy Efficiency Organisations, including CHP**

Association for the Conservation of Energy (ACE)	Ev. 236
Combined Heat and Power Association (CHPA)	Ev. 25
Energy Saving Trust (EST)	Ev. 55

**Environmental, Community, Fuel Poverty, Local Government & Religious Groups**

All Party Parliamentary Coalfield Communities Group	Ev. 74
Campaign for the Protection of Rural Wales	Ev. 235
Christian Ecology Link	Ev. 198
Diocese of Lichfield (Anglican team of Christian Ecology Link)	Ev. 207
Energy Action Scotland	Ev. 224
Environmental Industries Commission Ltd (EIC)	Ev. 50
Friends of Eden, Lakeland and Lunesdale Scenery (FELLS)	Ev. 7
Friends of the Earth (England, Wales & Northern Ireland)	Ev. 271
Friends of the Earth (North Wiltshire)	Ev. 8
Green Alliance	Ev. 274
Greenpeace	Ev. 238
Local Government Association	Ev. 270
Nottinghamshire & Derbyshire Local Authorities Energy Partnership	Ev. 223
Nuclear Free Local Authorities	Ev. 54
Renuc	Ev. 273
Scottish Opencast Action Group	Ev. 17
Sustainable Energy Task Force, Wildlife & Countryside Link, Climate Action Network UK	Ev. 21
SCARF	Ev. 30
SERA	Ev. 78

Welsh Anti Nuclear Alliance	Ev. 61
Woodland Trust	Ev. 75
WWF-UK	Ev. 87

### **Professional Organisations & Associations**

Architects and Engineers for Social Responsibility	Ev. 2
British Energy Association (BEA)	Ev. 66
British Nuclear Energy Society (BNES)	Ev. 33
British Nuclear Industry Forum (BNIF)	Ev. 42
CBI	Ev. 58
Country Land and Business Association	Ev. 5
Institute of Energy	Ev. 93
Institute of Physics	Ev. 91
Institution of Civil Engineers	Ev. 242
Institution of Nuclear Engineers	Ev. 63
Royal Academy of Engineering	Ev. 89
Royal Society of Chemistry, Scientific Affairs Board	Ev. 67
UK Petroleum Industry Association Ltd (UKPIA)	Ev. 64

### **Trades Unions**

British Association of Colliery Management – Technical, Energy & Administrative Management (BACM-TEAM)	Ev. 45
ESTUC	Ev. 266
GMB	Ev. 53
Prospect (& Trade Unionists for Safe Nuclear Energy –TUSNE)	Ev. 86

### **Major Energy Equipment Manufacturers**

Alstom UK	Ev. 36
Babtie Group Ltd	Ev. 239
Baxi Group Ltd (with SIGMA Elektroteknisk AS)	Ev. 282
NNC Ltd	Ev. 44

### **Other Companies & Organisations**

BAE Systems plc	Ev. 240
Cargill plc	Ev. 226
Chemical Industries Association	Ev. 234
Corus UK Ltd	Ev. 85
Gastec at CRE Ltd	Ev. 46
Global Oil Watch	Ev. 38
Impax Capital Corporation Ltd	Ev. 41
Institute for Public Policy Research (IPPR) Initial submission	Ev. 57
Institute for Public Policy Research (IPPR) Second submission	Ev. 267
NERA (National Economic Research Associates)	Ev. 84
Oxford Trust	Ev. 94
Sittingbourne Analytical Laboratory Ltd	Ev. 19
Supporters of Nuclear Energy	Ev. 20
Yorkshire Coal Task Force	Ev. 275

### **Energy Supply Industry & Energy Supply Trade Associations**

Amerada Hess	Ev. 230
Association of Electricity Producers (AEP)	Ev. 228
BG Group	Ev. 227
Bitor Europe Ltd	Ev. 82

British Nuclear Fuels plc (BNFL) submission	Ev. 27
BNFL (response to PIU's Nuclear Scoping Note)	Ev. 28
BP (preliminary)	Ev. 3
BP (second submission, which incorporates the first submission as an annex)	Ev. 80
BP (letter from Lord Browne of Madingley)	Ev. 83
British Association for Biofuels and Oils (BABFO)	Ev. 31
British Energy	Ev. 71
British Wind Energy Association (BWEA)	Ev. 251
Centrica	Ev. 60
Coal Authority	Ev. 272
Confederation of UK Coal Producers (Coalpro) and the National Association of UK Licensed Opencast Operators (Naloo) (joint)	Ev. 4
Conoco	Ev. 76
Edison Mission Energy	Ev. 90
Electricity Association	Ev. 39
Enterprise Oil plc	Ev. 285
Gas Forum	Ev. 237
Innogy	Ev. 43
London Electricity	Ev. 229
Marathon Oil, UK, Ltd	Ev. 9
Mining (Scotland) Ltd	Ev. 247
National Grid	Ev. 14
Northern Electric	Ev. 40
Oil and Gas Industry Leadership Team (see also UKOOA)	Ev. 269
PowerGen	Ev. 73
Renewable Power Association (RPA)	Ev. 264
Scottish Coal	Ev. 62
Scottish & Southern Energy plc	Ev. 246
ScottishPower (initial response)	Ev. 70 (a)
ScottishPower (response on transmission access & losses)	Ev. 70 (b)
Shell	Ev. 232
SEEBOARD plc	Ev. 283
TotalFinaElf Gas & Power Ltd	Ev. 145
TXU Europe	Ev. 284
UKAEA (on decommissioning)	Ev. 56 (a)
UKAEA (on fusion, with the Euratom Fusion Association)	Ev. 56 (b)
UK Coal Mining Ltd	Ev. 222
UK Offshore Operators Association Ltd (UKOOA)	Ev. 79
United Utilities	Ev. 48
Urenco Ltd	Ev. 88
World Nuclear Association (WNA)	Ev. 13

### Individuals

Gordon Adam MEP	Ev. 244
Jean Aldous	Ev. 268
Paul Allard	Ev. 100
Judith Smith Anketell	Ev. 106
Sir Eric Ash, Sir Geoffrey Allen, Sir John Cullen, Brian George, Sir Frank Gibb, Sir John Horlock, Dr Susan Ion, Dr Robin Jeffrey, Lord Tombs & Dr William Wilkinson (a joint submission)	Ev. 51
Mrs Maureen Akintewe	Ev. 217
Peter Assirati	Ev. 245
Sir Christopher Audland	Ev. 18
Katie Barfield	Ev. 201
Richard Barraclough	Ev. 130
Tim Biddulph	Ev. 183
Colin Bloodsworth	Ev. 147

John Blower	Ev. 250
Mike Boardman	Ev. 257
Helen Bonass	Ev. 192
Alan Bond, Reaction Engines Ltd	Ev. 225
Graham Bond	Ev. 142
John P Bond	Ev. 120
Graeme Bowman	Ev. 175
Dr M R Bradford	Ev. 219
Dr Neil W Braid	Ev. 196
Tom Brake MP	Ev. 138
Hilary Brown	Ev. 161
Clive Bruley & Sally Ford	Ev. 153
Florence Brutton	Ev. 150
Carolyn Buckley	Ev. 202
John Buxton	Ev. 181
Lucy Bywater	Ev. 108
Professor R A Cairns, University of St. Andrews	Ev. 95
Oliver Channell	Ev. 256
Katie Chown	Ev. 155
Mr and Mrs Peter Cloot	Ev. 131
Rosanne Cobb	Ev. 249
Lindsey Cook	Ev. 263
Rupert Corry	Ev. 137
Sir Alan Cottrell	Ev. 104
Professor Steve Cowley, Imperial College	Ev. 152
Meg Cowper-Lewis	Ev. 204
Nicholas Cox	Ev. 188
Mari Darby	Ev. 141
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Jill Davies	Ev. 154
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Alison Edwards	Ev. 164
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Katarina Ericson	Ev. 260
Andy Erlam, Touchstone Europe	Ev. 241
Tom Elsworth, Communiqué PR	Ev. 119
Lord Ezra	Ev. 35
Michelle Fawcett	Ev. 209
Cris Fells	Ev. 231
Professor Ian Fells, University of Newcastle & Fells Associates	Ev. 10
Dr David Fleming	Ev. 255
C B Ford	Ev. 170
Rodney Fordham (some notes on Scoping Paper)	Ev. 32 (a)
Rodney Fordham (paper on licensing of Sizewell)	Ev. 32 (b)
Rodney Fordham (paper on PWR nuclear power station risk problem)	Ev. 32 (c)
Louise Forster	Ev. 151
Mr J & Mrs N Fox	Ev. 111
Barbara Fraser	Ev. 163
Dr R W Gaisford	Ev. 144
Mr C J and Mrs L A Gammon	Ev. 148

Colin Godfrey, CLG Energy Consultants (a report for the Confederation of UK Coal Producers)		Ev. 68
Fiona Gomersall		Ev. 139
Jon Gibbins		Ev. 184
Anne Grainger		Ev. 96
Peter Gratton		Ev. 16
Jane Grimshaw		Ev. 214
Walter Guy		Ev. 105
Janet Hackney		Ev. 116
Professor M G Haines, Head of Plasma Physics Group, Imperial College	Ev. 221	
Mrs P Harpuc		Ev. 149
Michael Haseler, Intronic Technology Ltd		Ev. 65
David Hayes		Ev. 114
Dr Dieter Helm, New College, Oxford		Ev. 6
Dr Philip K Holland		Ev. 167
John Hondros		Ev. 194
Dr Keith I Hopcraft, University of Nottingham		Ev. 117
Andrew Horsler (Initial Note)		Ev. 29 (a)
Andrew Horsler (response to PIU's Coal Scoping Note)		Ev. 29 (b)
Dr David S Hubble		Ev. 128
Mr Dick and Mrs Angela Hughes		Ev. 211
Michael Iddon		Ev. 123
John Ingham		Ev. 102
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Steuart Wight	Ev. 278

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