

Final Version 1March05 : APGTF Response to UK Climate Change Consultation

**RESPONSE TO GOVERNMENT'S CONSULTATION ON  
REVIEW OF UK CLIMATE CHANGE PROGRAMME**

**UK Advanced Power Generation Technology Forum**

**February 2005**

## **TABLE OF CONTENTS**

### **1. INTRODUCTION**

### **2. BACKGROUND TO THE APGTF's POSITION**

### **3. RESPONSES TO SPECIFIC QUESTIONS**

#### **3.1 Generic Questions – Paragraph 2.30**

#### **3.2 Energy Supply – Section 6**

#### **3.3 Energy Supply – Section 6 Questions**

### **4. CONCLUSION**

*This document has been prepared by the Advanced Power Generation Technology Forum (APGTF)<sup>1</sup> in response to HM Government's Consultation Paper on 'Review of the UK Climate Change Programme'. Views are those expressed by the members of the organisations and put into a consolidated form.*

## **1. INTRODUCTION**

The UK Climate Change Programme was published in 2000 and put in place the national framework to tackle the challenge of climate change. It included an ambitious set of policies and measures to reduce greenhouse gas emissions to enable the UK to meet its Kyoto target and move us towards our national goal of reducing carbon dioxide emissions by 20 per cent on 1990 levels by 2010. It included a commitment to carry out a formal review in 2004 – the subject of this consultation response from the APGTF.

## **2. BACKGROUND TO THE APGTF's POSITION**

It is clear that fossil fuels will form part of the UK's energy mix in respect of electricity production well into the 21<sup>st</sup> century and that if the Government's target of a 60% reduction in CO<sub>2</sub> by 2050 is to be realised, then carbon abatement technologies (CATs) will be required – a view confirmed by the Government's own analysis (paras. 6.26-6.27 in the Consultation Paper). Whilst there is some uncertainty as to the level of renewable and nuclear energy in the coming decades, the expected increase in gas and sustained presence of coal will require CATs to be developed and applied quite extensively. However, the Climate Change Programme has had little regard for the development and implementation of CATs, despite Government figures acknowledging the importance of fossil fuels in power generation.

**Paragraph 2.6** of the consultation document states *"Although the UK's emissions represent only a small proportion of the global total, as a developed country our per capita emissions are much higher than the global average. The Government and the devolved administrations believe that the UK must take a leading role in the fight against climate change"*.

Given this imperative, there needs to be clear Government stimulus, in respect of clear messages, leadership, funding, and incentives to accelerate the development, demonstration and widespread

---

<sup>1</sup> APGTF is a Foresight Associate Programme that provides the focus for the UK Power Generation Sector on power generation technologies for fossil fuels, biomass and associated technologies. It comprises a broad range of companies and interests who participate mainly as members of the key Trade Associations and Groupings, e.g. the power generators and users, equipment manufacturers and fuel suppliers (namely Association of Electricity Producers, Combined Heat and Power Association, BEAMA Power/Power Generation Contractors Section, Industrial and Power Association, the Confederation of UK Coal Producers and representatives from the oil/gas industry) together with representation from the Research Community, Government (DTI, DTI-OST and DTI-SEPU) and the Funding Agencies (EPSRC).

implementation of CATs. The current electricity trading arrangements have resulted in a period of low prices for electricity wholesalers and merchant generators and this in combination with regulatory uncertainties and capital market's apprehension have acted to stifle investment in new generation plant.

It is clear that gas figures prominently in Government thinking as an integral part of the Climate Change Programme through fuel switching away from coal. Perhaps because of this the future use of coal has not received the attention that it has in other large, mature economies notably USA, Germany, Japan and Australia, where coal is seen as being more competitive than gas. Without this, there is understandable reticence for owners of coal plant to invest in any longer term technologies which target significant reductions in CO<sub>2</sub>. This situation is compounded by the likely impact of the Large Combustion Plant Directive (LCPD) on coal plant which has already resulted in a large capacity of coal plant being 'opted out' and eventually closed rather than meeting stringent new limits for NO<sub>x</sub> and SO<sub>2</sub>. The likely closure of opted-out plant post 2012 and the coincidental closure of the older nuclear plant, i.e. AGRs, will result in insufficient generation capacity on the system. Therefore, new plant will need to be built. If this is to be fossil fuelled (and this is likely), then the impact of its future CO<sub>2</sub> emissions needs addressing at the planning stage, which is imminent.

In the Energy White Paper, CATs are viewed as necessary to maintain a role for coal in the medium to long term, but the treatment of gas plant will also be needed to achieve the UK's long-term CO<sub>2</sub> reduction targets. Government support for CATs and a CATs Research, Development and Demonstration (RD&D) strategy is needed and it is needed now.

**Paragraph 2.22** of the consultation document states "*Achieving our long-term objectives for climate change will offer new opportunities for UK companies, particularly in the areas of renewable energy, energy efficiency, and the development of alternative fuels and new vehicle technologies*".

This paragraph fails to recognise the major opportunities for UK companies in Carbon Abatement Technologies for fossil fuel power plant. The DTI has been promoting the opportunities in these technologies and the DTI is currently preparing a Strategy to promote their use (See paras 6.26-6.27 in the Consultation Paper) having recognised the environmental benefits in the UK and globally, to be gained through exports and technology transfer. This strategy needs to be adopted as part of the Climate Change Programme.

The size of the environmental challenge and the magnitude of the business opportunities are indicated by a recent publication by the International Energy Agency (IEA) of the World Energy Outlook 2004. This shows that total world primary energy demand in 2002 exceeded 10,000 Mtoe<sup>2</sup> of which 80% was met by fossil fuels. Demand is expected to increase by about 60% up to 2030 with fossil fuels continuing to meet more than 80% of demand (i.e. 22% coal, 35% oil and 25% natural gas). The IEA predicts that between now and 2030, the global market for new generating plant is expected to have a value of \$4100 billion, and the large majority of this is going to be fuelled by coal or gas, with coal remaining the most used fuel. The implication of this

---

<sup>2</sup> Million tonnes of oil equivalent

trend is for energy related CO<sub>2</sub> emissions to increase by 62% from 23.6 GT per year to 38.2 GT per year.

**Paragraph 2.28** refers to the UK's G8 Presidency for 2005 and it refers to the Prime Minister's speech on 14 September 2004 in which he set out three broad aims for 2005. Paragraph 2.28 gives these aims as:

- ?? To build a solid foundation on the science
- ?? To reach agreement on a process to speed the science, technology and other measures necessary to meet the threat
- ?? To engage countries outside the G8 who have growing energy needs, like China and India, both on how these needs can be met sustainably and how they can adapt to the impacts of climate change that are already inevitable

The APGTF believes that the UK must use its Presidency to ensure the global development and implementation of CATs, which will be essential in achieving the second and third aim points and the UK should position itself to take the lead on this.

Finally, the Terms of Reference for the review are given in **paragraph 2.25**; these include:

- ?? To identify and evaluate the options for putting the UK on a path to a 60% reduction in carbon dioxide emissions by 2050 by delivering further reductions in greenhouse gas emissions through to 2010, 2015 and 2020
- ?? To set out how we intend to ensure the UK achieves its Kyoto target and continues to move towards its domestic carbon dioxide goals
- ?? To assess the costs and benefits to the UK and to UK business of the proposed revised programme of action to reduce emissions

The APGTF believes that the development and implementation of CATs will be essential in order for the UK to achieve its long term targets and further more this course of action has the potential to bring significant benefit to UK business. The DTI's proposed CAT Programme, including R&D, full-scale technology demonstration and support for deployment in the commercial market place, should now form a key component of the UK's Climate Change Programme and be given adequate financial support to complement the support provided in other areas.

### **3. RESPONSES TO SPECIFIC QUESTIONS**

#### **3.1 Generic Questions – Paragraph 2.30**

**Q3: “Do you agree with the overall analysis of projections and impact of existing measures?”**

We consider that actual emissions will be determined by a series of factors over which the government, currently, has little control, e.g. price of gas, price of coal, value of European Emissions Trading certificates, weather/wind patterns.

If the over-arching target of 60% reduction by 2050 is to be met then action must be taken on all fronts in parallel, in particular Ofgem regulation.

**Q8: “What new measures for reducing carbon dioxide emissions might be considered?”**

The new measures – many available now – are “Carbon Abatement Technologies for Fossil Fuels” (as mentioned in the Consultation Paper in paras 6.26-6.27). CATs cover a range of generic options for reducing the CO<sub>2</sub> emissions from fossil fuel plant. These include:

1) Higher efficiency conversion processes – the amount of fuel consumed, and the associated emission of CO<sub>2</sub>, is reduced when conversion processes (e.g. power generation) are made more efficient. This can contribute emissions reductions of 20-30% depending on the performance of the old and replacement plant. For example increasing the efficiency of coal-fired power generation plant from 36% to 45% reduces emissions by 20%.

2) Fuel switching to lower carbon alternatives – the main example for the UK is the replacement of coal-fired power generation with natural gas, which reduces emissions by about 50% per unit of output. However, there are other options such as co-firing with 10-20% CO<sub>2</sub> neutral bio-energy, which can deliver emissions reductions of 10-20%.

3) CO<sub>2</sub> Capture and Storage (CCS) – in which the carbon in fossil fuels is captured (as CO<sub>2</sub>) either before or after combustion and committed to long term storage in geological formations. This approach can reduce emissions by up to 90%.

The technologies, which can be implemented in a staged way, can give progressive reductions in CO<sub>2</sub> emissions from coal-fired or gas-fired power plant. With biomass cofiring and CO<sub>2</sub> capture it is possible to completely eliminate the net CO<sub>2</sub> emissions from coal-fired plant.

UK efforts to support carbon capture and storage should be increased and be at least comparable to those to support renewable technologies such as wave and tidal power. Consideration should be given to initiating a demonstration commercial project with international collaboration.

**Q9: “On what basis should new measures be decided? How should we assess the practicality, cost-effectiveness and distributional implications of possible measures to ensure a balanced and equitable programme?”**

Factors affecting the choice of future generation will include:

- 1) Cost-of-electricity generation p/kWh
- 2) Cost of avoided carbon dioxide emissions £/tCO<sub>2</sub>
- 3) Whether or not the measure contributes to security-of-supplies and to balancing varying demand versus varying supply. If a fuel can be readily stored (like fossil fuels and biomass) and the plant is flexible, then the plant can be used to balance the system, and support a system with a large intermittent renewables element.

Carbon-abatement technologies perform well against these criteria.

However, the APGTF believes the measures and objectives should be broader than meeting the aims of the Energy White Paper. The objectives should include maximisation of global environmental benefit and trade through exports and technology transfer:

- ?? When seeking to maximise environmental benefits, the government should look globally and not focus only on the UK. Carbon abatement solutions need to be suitable for global application if they are to make a worthwhile impact. In this context it should be recognised that Britain burns only 2% of the coal and 5% of the natural gas used for power generation worldwide. If this broad global view is taken it is clear that carbon abatement technologies will be needed for both coal and gas, for both new plants and existing plants.
- ?? The government should seek to maximise environmental and trade benefits through exports and technology transfer. Much larger global environmental benefits can be achieved if technologies researched, developed and demonstrated in the UK are exported overseas to the countries that use much larger (and growing) quantities of fossil fuels. Trade benefits can be achieved through a range of business models including licensing and technology transfer, joint ventures, etc. whilst the technology ownership remains vested in the UK.

### **3.2 Energy Supply – Section 6**

The APGTF welcomes the planned publication of the Carbon Abatement Technology Strategy which is directly relevant to three important aims of the Climate Change Programme Review:

- ?? meeting UK goals to reduce emissions (in the medium- and long-term)
- ?? reducing global greenhouse gas emissions
- ?? opportunities for innovation, business and investment growth.

### **3.3 Energy Supply – Section 6 Questions**

**Q18: “Overall, considering a) the contribution already and that expected from the energy supply industry and b) the possible impact on the three other key goals of energy policy (fuel poverty, competitive markets and security of supply) what scope is there for additional emissions reductions from the energy supply sector to 2010, and to 2020?”**

In reality, there is no further scope for additional emissions reduction from the energy supply sector up to 2010 and beyond to 2020 unless new nuclear stations are built or carbon capture and storage is adopted for fossil-fuel generation. The current nuclear closure programme, unless life extensions are applied to the AGRs, will leave only Sizewell B open in 2020. These stations will be replaced by fossil-fuelled plants with the result that emissions will rise. Moreover, the growth in renewables will be effectively negated by the continued growth in UK electricity demand.

Fitting of Carbon Abatement Technologies to the remaining coal-fired generation would give additional CO<sub>2</sub> reduction whilst positively contributing to the other three key goals of energy policy: security of supply, alleviation of fuel poverty and national competitiveness.

Based on the DTI's Updated Emissions Projections (11 November 2004 and addendum), it is predicted that in 2020 the remaining coal-fired fleet will be generating 62 TWh. The CO<sub>2</sub> reductions per year that are possible by retrofitting CATs are:

- (i) advanced supercritical retrofits    ~ 9 MtCO<sub>2</sub>/yr    see note 1
- (ii) biomass co-firing                    ~10 MtCO<sub>2</sub>/yr    see note 2
- (iii) CO<sub>2</sub> capture and storage            ~32 MtCO<sub>2</sub>/yr    see note 3
- ~51 MtCO<sub>2</sub>/yr

Note 1 this is based on a 16% reduction from 12GW of plant

Note 2 this is based on co-firing 20% biomass by heat input on 12GW of coal fired plant

Note 3 this is based on the capture of 90% of the remaining CO<sub>2</sub> after implementation of (i) and (ii), and assumes that capture reduces efficiency by 8%age points.

These are additional to the CO<sub>2</sub> savings from the measures introduced in the Energy White Paper, i.e. renewables and fuel switching.

However, there are current barriers to the implementation of CATs in the UK arising from uncertainties around:-

- the implementation of the LCPD
- lack of future certainty in the electricity generation market
- the impact of the Emissions Trading System (ETS) on the future price of CO<sub>2</sub> credits together with National Allocation Plans post 2008. Currently the CO<sub>2</sub> price is too low to drive change, partly as a consequence of CO<sub>2</sub> allocations in other EU countries being too generous. Utilities are consequently nervous that in 2008 allocation plans will be significantly tighter. However it is clear that the ETS will have a major influence on the future financial structure under which new investments will have to be made, despite the uncertainty of the value of CO<sub>2</sub>.
- the future price and availability of gas relative to coal.
- lack of government support for first-of-class demonstration coal power plant. Such demonstration funding is available for wind, wave/tide and photovoltaics but not for fossil-fuelled plant.

The market is failing to drive the emissions reductions that are required, except perhaps in the area of biomass where the short-term subsidy in the form of ROCs justifies the relatively modest investments to allow co-firing.

Hence despite the relatively low cost of carbon abatement through efficiency improvements on a coal-fired plant the utilities are unable to justify the investment.

Energy supply requires considerable capital investment with paybacks over a long period of time. A stable investment environment for reduced emissions technologies is the best scenario to foster additional emissions reductions.

**Q19: “What further initiatives might the Government consider at the EU, national, regional or local level to deliver further carbon savings to 2010, and to 2020? In particular, what cost effective steps can Government take to promote the wider uptake of micro-generation (such as micro-CHP and embedded renewables)? What would be a realistic level of CHP capacity by 2020 and how should the Government set about achieving it?”**

### **CATs**

Continuation of RD&D for CATs in the UK is essential with support from Government, with particular emphasis on demonstration leading to commercial deployment from 2010 onwards.

The Government should seriously consider providing the necessary stimulus that leads to the commercial demonstration of higher efficiency coal fired plant to a) provide the opportunity for coal to be considered as a part of the future energy mix and b) provide incremental, but significant, reductions in CO<sub>2</sub> while CO<sub>2</sub> capture and storage options are being developed and demonstrated.

It will be essential that the UK is part of international world-wide initiatives and takes a leadership role, certainly for the activities that address the ‘big’ issues that relate to global climate change. In doing so, care must be taken to ensure that, where broad collaboration takes place, the UK secures direct benefits – historic evidence suggests that this has not always been the case with large, international, multi-partner projects.

Within Europe the same stance should apply. There will be significant benefits to come from any synergies between the national programmes in individual EU member states, from sharing of experience and from joint projects (probably best done on bi- or tri-lateral arrangements between different countries within Europe). An initiative involving the countries around the North Sea could be particularly beneficial around the topic of CCS, including EOR, which again could lead to commercial implementation from 2010 onwards.

The Government should consider allowing biomass co-firing post 2016, as this will help to ensure a more efficient and extensive use of biomass, in new as well as existing plant, providing greater displacement of fossil fuels and hence a larger CO<sub>2</sub> reduction. It should also encourage a wider definition of energy crop to increase the potential scope of supply and hence the volumes of biomass fuel available. It should also provide incentives to encourage full utilisation of the waste heat from biomass plant to ensure greater overall efficiencies, particularly from dedicated plant which lends itself to being incorporated into CHP schemes more easily.

If the hydrogen based economy in which the emission of carbon to the atmosphere is totally eliminated, is to become a reality, then hydrogen generation from fossil fuels with CCS is a serious option. Opportunities for projects for hydrogen production from fossil fuels with CCS are

likely to arise under the EU FP6 or FP7 programmes. Opportunities should be identified for UK to participation in EU projects in this area. This again requires the UK to have a reasonable activity in this area in order to take the maximum benefit from such programmes.

## CHP

Without further changes in policy, the level of CHP in the UK is unlikely to rise much above the current level of 5GW. A realisable target by 2020 might be around double this level.

The development of CHP in the short to medium term is constrained by a number of factors:

- /// High gas prices, especially in comparison to prices paid for electricity
- /// Insufficient 'regulatory' incentives for CHP
- /// Lack of regulatory certainty over the economic lifetimes of CHP plant
- /// Loss of CHP development base in the UK
- /// Inconsistencies between Defra and DTI approaches
- /// Inconsistencies in the application of policies – rates, LECs etc
- /// State of UK manufacturing sector

New measures are needed to overcome these constraints.

### **Q21: “What more should the Government be doing to ensure new technologies are available to maximise further cost effective carbon savings for the energy supply sector up to 2020?”**

Although Carbon Abatement Technologies are available now, their widespread adoption will be facilitated by RD&D aimed to reduce costs, improve reliability and improve operational flexibility. The Government should support a substantial RD&D programme to run alongside national programmes in, for example, the USA, Canada, Australia, Norway, Germany and Japan, as well as European programmes. It is hoped that this will be announced in the DTI CAT Strategy.

Government should promote the development of an infrastructure for CO<sub>2</sub> capture and storage, including a CO<sub>2</sub> transport pipeline. This could be started now with currently available amine-based capture technology which could be retro-fitted to existing coal or gas fired plant if the reduction of efficiency that this would entail could be justified, although it is more sensible to retrofit CO<sub>2</sub> capture plant to new or suitably refurbished, higher efficiency plant. However, fiscal incentives would be needed to encourage any generator to fit capture technology to their power plant

It is essential to support demonstration of new technologies (ie not just R&D) and to commit a long-term budget commensurate with the size of the opportunities for CO<sub>2</sub> saving indicated above. Quoting the Prime Minister, “*To acquire global leadership on this issue, Britain must demonstrate it first at home*”. (Speech to Prince of Wales’ Business and Environment Programme, 14 September 2004).

Finally, it is also becoming increasingly difficult to find suitably qualified professional, technical and operative personnel to implement measures. Thus, although it will not have an impact by 2010, there is a desperate and growing need to encourage education and training in the areas of engineering and technology if the UK is to establish a truly sustainable future.

#### **4. CONCLUSIONS**

- ?? The APGTF believes that the development and implementation of CATs will be essential in order for the UK to achieve its long term targets and furthermore this course of action has the potential to bring significant benefit to UK business
- ?? CAT technologies, some of which are available now, can be implemented in a staged way to give progressive reductions in CO<sub>2</sub> emissions from coal-fired or gas-fired power plant. However, there needs to be clear Government stimulus, in respect of clear messages, leadership, funding, and incentives to accelerate the development, demonstration and widespread implementation of CATs
- ?? The APGTF believes that Government support of at least £100 million for a CAT RD&D programme over the next five years can be fully justified on the basis of avoided CO<sub>2</sub> emissions. Such a programme would complement the efforts to increase end-use energy efficiency and to develop renewable energy sources to allow real progress to be made on reducing CO<sub>2</sub> emissions. The DTI's proposed CAT Programme should form an integral part of the UK's Climate Change Programme.
- ?? Energy supply requires considerable capital investment with paybacks over a long period of time. A stable investment environment for reduced emissions technologies is the best scenario to foster additional emissions reductions.