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APGTF Response to HM Treasury CCS Consultation

UK HM Treasury Consultation
on
Carbon Capture and Storage
Barriers to Commercial Deployment

UK Advanced Power Generation Technology Forum

May 2006

The Advanced Power Generation Technology Forum (APGTF) has prepared this document in response to HM Treasury Consultation Paper on Carbon Capture and Storage: Barriers to Commercial Deployment. Views are those expressed by the members of the organisations and put into a consolidated form. The 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).

This response to the consultation is based upon the APGTF input to the UK Energy Review being carried out in parallel with this HM Treasury specific consultation.

1. BACKGROUND TO THE POSITION OF THE APGTF

It is clear that fossil fuels will form part of the UK's energy mix in respect of electricity production well into the 21st century and that if the Government's target of a 60% reduction in CO₂ by 2050 is to be realised, then carbon abatement technologies (CATs) will be required – a view confirmed by the Government's own analysis in support of the White Paper and the Government's CAT Strategy. 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 – this will ensure a reliable and secure supply of electricity with the ability to match the fluctuations in demand.

It is accepted by the APGTF that carbon capture and storage (CCS) is a critical element of CATs and the clean use of fossil fuel. It therefore welcomes the consultation on barriers to the implementation of CCS.

The key challenges as noted by the APGTF in its submission to the Energy Review are:

- 1) To deliver a sustainable climate change policy that is robust to future uncertainty. This must provide the largest long-term economic signal to invest in CATs that is consistent with maintaining international competitiveness.
- 2) Support the development and demonstration of emerging fossil-fuelled power generation technologies that have the potential to play a significant role in our future generation mix
- 3) Government policy should recognise the suitability of technologies for global application, tapping into the export potential for UK plc and maximising the environmental impact worldwide.

All these have a direct relevance to the consultation on CCS.

2. RESPONSES

○ Carbon Reductions and Regulatory Issues

The APGTF considers 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.

In reality, there is limited 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 will result in these stations being 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 CATs to the remaining coal-fired generation would give additional CO₂ reduction whilst positively contributing to the other three key goals of energy policy: security of supply, alleviation of fuel poverty and national competitiveness. 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 CO₂ credits together with National Allocation Plans post 2008.
- lack of sufficient 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.

Energy companies will efficiently deliver investment in an appropriately diverse portfolio of assets, including clean coal, provided:

- There is a sustainable and credible climate change policy framework which is robust to future uncertainty, and
- Regulators/Governments do not intervene to reduce investment returns

The UK climate change policy must deliver the largest long-term economic signal to invest in low carbon technologies that is consistent with maintaining international competitiveness - explicit recognition of the international landscape of climate change policy is critical to a sustainable UK climate change policy.

○ Technology Related Issues

Firstly, it is the view of the APGTF that mature technologies should not be excluded as often these can form the basis for the development and deployment of emerging technologies that have the potential to play a significant role in the future generation mix. CATs is a prime example where efficiency improvements at both component and system level are a fundamental part of the successful deployment of CCS technologies.

Factors affecting the choice of future generation will include:

- 1) Cost-of-electricity generation p/kWh
- 2) Cost of avoided carbon dioxide emissions £/tCO₂
- 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. In particular, clean coal plant can close the energy gap in 2015/2020 and deliver security of supplies and emissions reductions at reasonable cost – this would also allow the UK to make the most of the benefits of indigenous coal production.

Preparing the way for zero emission will be essential and so the introduction and acceptance of 'capture ready' technologies will be important. As is widely recognised, the UK will be required to replace retiring coal and nuclear plant and so up to 29GW (18GW due to closures and 11GW due to growth) of new generation plant could need to be operational by 2015. Consequently, a large amount of new plant will have to be built within the next 10 years, so action is needed urgently.

Making provision in the future for CO₂ capture should be an important element of the approach that is taken so as to ensure that 'carbon lock-in' does not occur. Whatever plant is put in the next decade will be still be operational by 2050 and so the choice of technology now will be critical in the adoption of an 'open' strategy with regard to CO₂.

○ **UK Capability Related Issues**

The APGTF believes the Government's measures and objectives should be broader than meeting the requirements of the UK electricity system. 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.
- 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.

The UK is recognised as having a strong basis in this field (as referenced in the DTI Strategy for Developing Carbon Abatement Technologies for Fossil Fuel Use, published in June 2005, and which the APGTF supports strongly). Early adoption of CCS and related technologies in the UK

would take advantage of this and, as the DTI document states, “ensure that the UK takes a leading role in the development and commercialisation of Carbon Abatement Technologies [including CCS] that can make a significant and affordable reduction in CO₂ emissions from fossil fuel use”. This would involve power plant operators, power engineering companies, process engineering companies, fossil fuel suppliers, offshore engineering and service organisations, electricity and gas shippers and project developers. A major benefit would be the working together of these companies, something that has not traditionally happened in the past, in a manner that would equip them to trade effectively on global markets as well as satisfying needs in the UK.

Availability of the appropriate skills is becoming increasingly of concern. In a recent report to the APGTF in May 2006, the I.Chem.E reported on the outcome of a survey in which contractors with UK offices were asked whether they were willing to bid, either alone or as leader of a consortium, for clean coal power stations. Four clean coal technologies were considered, two using coal burning, and two, gasification. The two burning technologies were one with air followed by scrubbing the CO₂ from the flue gas, and the other with oxygen, recycling some of the CO₂ to make O₂ / CO₂ air substitute for the combustion. The gasification technologies were one with an integrated plant with pre-combustion capture of CO₂ and the other a gasification unit containing the capture unit contracted separately to the power island. 10 contractors were contacted and nine opted to participate in the survey. The outcome was as follows : all four technology routes were supported by at least two contractors prepared to offer a single turnkey bid with guarantees as shown by the table below.

	Leader of Consortium Bid	Single Turnkey Bid
PF with Flue Gas Scrubbing for Capture	8 ✓	4 ✓
IGCC with Pre-Combustion Capture	8 ✓	2 ✓
Oxyburn	6 ✓	3 ✓
Gasification Module plus Power Island	8 ✓	4 ✓

This indicates that there should be the capability within the UK for satisfying the potential UK need around CCS but it was emphasised that this capability will be operating in the global market and, with the increase in interest and adoption of CAT/CCS projects worldwide, this resource will be under severe pressure.

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 Mtoe¹ 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 trend is for energy related CO₂ emissions to increase by 62% from 23.6 GT per year to 38.2 GT per year.

¹ Million tonnes of oil equivalent

In terms of CATs for fossil fuel, it is estimated that the above figures would translate to a requirement for ~3000GW over the period 2005 to 2050, approximately half for coal. In monetary terms this represents ~£1500b. Such technologies include high efficiency plant (a fundamental part of the strategy towards zero emission power generation as noted earlier) as well as CCS but if the right fiscal and regulatory frameworks were in place, it could be possible that approximately 10% could be directly CCS. Assuming that UK companies would secure somewhere around 5% (a representative figure based on experience and the current competitive market, both system and component supply), this would represent some £7-8b of business benefit to the UK. Such benefit would only come from a robust programme nationally, including reference plant here in the UK to provide necessary confidence internationally. This in turn requires the right economic encouragement to establish “first of a kind plant” in the shorter term and the consequent confidence to go to “many of a kind” plant through the appropriate regulatory and fiscal framework in the longer term.

Also if the appropriate regulatory and fiscal frameworks are established within the next 2-3 or so years, there is likely to be a substantial increase in the take-up of CCS and related technologies. This would be part of the replacement/expansion of the UK generation capacity required within the next 1-2 decades and would occur in a similar timeframe to other major infrastructural actions within the UK (for example, the 2012 London Olympics in the shorter term to the expansion of the rail system/transmission and distribution network in the longer term). This would undoubtedly put pressure in the UK on the availability of appropriately trained and experienced personnel at all levels, from professional engineering status to traditional trade skills, a situation that would be exacerbated by the above-mentioned demand for the same skills worldwide.

This potential skills shortage needs addressing on an urgent basis at all levels within the educational system, especially in schools. One critical issue is to indicate to the younger generation that there is a worthwhile career in energy and engineering. This can only come from there being vibrant business in this area. This in turn requires strong signals from government (ie the appropriate framework referred to above) that would encourage the necessary investment to be made and so create the employment opportunities in the CAT/CCS business area.

○ **International Related Issues**

In the area of carbon abatement technologies, it is the view of the APGTF that it would 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).

The UK is already involved in developing initiatives in the EU, US, North Sea rim, China and the Carbon Sequestration Leadership Forum (CSLF). The Government needs to fully support these initiatives and to support any appropriate new ones as they appear.

The DTI Carbon Abatement Technology strategy for fossil fuel with its recognition of the need to collaborate internationally is very much welcomed. It is now about having an implementation plan commensurate with this strategy. The DTI has agreed to release £35M through a capital grants scheme for UK investment in reducing CO₂ emissions from generation with fossil fuels. This amount is welcomed but will only be a fraction of what is required to have some sensible commercially sized demonstration projects that will give confidence in the technology and promote its use nationally and worldwide.

CO₂ reduction and Carbon Capture and Storage (CCS) technologies are being developed both within and outside of the UK, especially as part of the European scene. A EU Technology Platform into “Zero Emission Fossil Fuel Power Plant” has been formed and brings together the key industrial players from the oil/gas, generator and equipment supply parts of the sector to set a strategy out to 2030 and beyond. Many UK-based companies are part of this initiative. One of the key outputs will be the recommendation for a series of demonstration plant in Europe.

In order for the UK to take advantage of such an approach, it needs a robust CAT action that includes incentives for early demonstration of zero emission fossil fuel technologies and a stable economic and regulatory framework that will encourage a continuing take up of projects in the longer term.

Having such an action should ensure that the UK is an attractive country in which to develop, demonstrate and deploy “clean fossil” technologies with the consequent benefits to UK-based industry. It will therefore enable confidence in the technology to be established and to provide “reference plant” which will encourage developing countries, such as China and India that will continue to rely on fossil fuels for decades yet, to adopt such technology. Such an engagement will require some cost effect retrofit applications of carbon capture and storage and adoption of a “capture ready” approach that will allow capture technologies to be introduced when the fiscal and regulatory conditions are appropriate. The value of CO₂ will be a critical parameter especially after 2012 where at present there is no visibility at all.