



**Advanced Power Generation Technology Forum,
in conjunction with the Coal Research Forum**

The 12th Annual APGTF Workshop: 'Carbon Capture & Storage – can the UK maintain a leadership role?'

**'1VS' (1 Victoria Street) Conference Centre, Westminster, London
Tuesday 13th & Wednesday 14th March 2012**

REPORT ON PANEL SESSIONS

Tony Oliver, APGTF

INTRODUCTION

While CCS certainly remains a relevant and important technology to address climate change, and while the magnitude of the challenge and the need for rapid action is generally recognised, the global context for CCS has changed considerably over the last couple of years and progress has been slow. In the UK too, the context has changed: the Electricity Market Reform activity, the decision not to proceed with the Longannet CCS project, the interest in CCS for gas-fired plant....

So, it was timely that the APGTF 2012 Workshop reflected on this new context and considered whether the UK can 'maintain a leadership role'.

Day 1: ‘RD & D activities in the UK – a good news story?’

The one certainty around the development of a new industry is that it will be difficult. Given the recent disappointing news on ‘Demo 1’ and the lack of clarity around the programme for future demonstration projects, it is easy to feel despondent about CCS in the UK. However, there is a very positive story to tell on progress being made in RD&D which is worth shouting about!

In August, the APGTF published its latest technology strategy 'Clean Fossil Power Generation in the 21st Century - Maintaining a Leading Role'. This laid out a 'blueprint' for RD&D to provide the carbon abatement technologies for fossil fuels that the UK will need in order to meet our climate change targets. Day 1 of the Workshop used this strategy as a framework to look in detail at the progress of the technologies and the challenges ahead.

Presentations and discussions focused on:

- CCS RD&D – what needs to be done in the UK and when?
- UK RD&D funding – what is the latest news from the Energy Technologies Institute, the Technology Strategy Board, the Research Councils and the Biomass and Fossil Fuels Research Alliance?

What is being done or planned at a large scale in the UK (lessons from FEED studies, pilot-scale capture projects, CO₂ transport initiatives and storage assessments)?

- What is the likely impact of fundamental research underway or planned in the UK and what ‘hardware’ is in place to support it?
- Have we got our priorities right and is there sufficient knowledge transfer?

The Secretary of State for Energy and Climate Change (Edward Davey) announced a £20 million innovation programme to support CCS R&D with the primary aim of reducing the cost of CCS.

Day 2: ‘Building on firm foundations for a commercial reality’

Building on the UK’s successful RD&D landscape that was examined in Day 1, Day 2 addressed the question - How do we turn CCS into a commercial reality? By looking at how things are shaping up for CCS in the future - globally, in Europe and in the UK - Day 2 enabled us to have a 'stock-take' of where we are. In addition, some of the technical and non-technical issues that are also crucial to the longer term and more widespread deployment of CCS were considered.

Presentations and discussions focused on:

- The climate change context for CCS
- The international scene – what are the current progress, achievements and priorities in the European Union and globally?
- UK strategy – priorities and initiatives for CCS, notably further particulars of the CCS Innovation Programme announced on Day 1
- ‘Show-stoppers’ and other key issues – public perception and acceptance, training for CCS in UK academe, CCS for industrial sources, bio-CCS

- A panel discussion on ‘can the UK maintain a leadership role in CCS?’.

This 2-day workshop consisted of invited presentations (see programme at the end of the document), which can be found on the APGTF website (www.apgtf-uk.com). Each day, these were followed by panel sessions in which panel members and all delegates were invited to express their views on the themes of the day. The output from the workshop will be fed into the Government and other national and international funding agencies to help ensure success with CCS for the UK.

This document is a report of the panel sessions and the accompanying discussion sessions.

ATTENDANCE FIGURES

A total of 121 delegates attended either one of the days or both days, comprising representatives of industry, commerce, academia, Government, funding agencies plus other stakeholders and interested persons.

DAY 1 PANEL SESSION

The panel was chaired by Philip Sharman, Chair of the APGTF and the panel members were:

Tony Espie	BP Alternative Energy
Jon Gibbins	Edinburgh University
Robin Irons	E.ON
Greg Kelsall	Alstom Power
Steve Marshall	Petrofac

The broad objectives of the panel session were to consider:

- *What RD&D needs to be done in the UK?*
- *Whether we have got our priorities right and if there is sufficient knowledge transfer.*

The Chair started the session by posing the following question to the panel and then the delegates were invited to provide answers or comments as appropriate.

What are the highest priorities and biggest stumbling blocks that could impact on achieving the target of commercialisation and roll out of CCS in the UK by 2020?

A variety of answers and comments were put forward from the panel and from the floor; the main points are listed below.

- There are no fundamental technical problems but there are business barriers mainly associated with cost and risk both of which need to be reduced
- One of the main issues is the lack of knowledge of the key stakeholders. Key risks are seen as in transport and storage. High risk or uncertainty results in higher cost
- Scale-up is still an issue with risk uncertainty and cost and also with multi injections into a single storage site
- On storage, some risks and uncertainties are known about, others can be resolved by suitable investigations
- The planned large demos are needed to ensure progression to commercial roll-out
- A robust analysis of EMR and its impact is needed for CCS
- EMR could be the key driver for CCS in the UK, more so than the carbon price
- CCS plant must be ‘dispatchable’, flexible power to provide back-up security for a mixed portfolio with renewables and nuclear
- There is a need to communicate the cost/benefit of CCS in terms of its value in providing flexibility and security on the grid.

The Chair then posed another question:

Is there sufficient knowledge transfer in place and in particular have we learnt the lessons from 'Demo 1'?

A variety of answers and comments were put forward and the main points are listed below.

- Learning is going on in procurement but it is not clear if it is in the commercial process
- There is a need to think more of reducing or managing commercial risk
- It is becoming clear that post the full scale demos, there needs to be a commercial driver to ensure completion of the move to commercialisation. Will the EMR or carbon price provide it?
- The £20m R&D package that was announced was welcomed and should help reduce costs. However, the timescales are likely to be such that this may not benefit the initial full scale demonstrations but it should be beneficial for subsequent full scale plant. Technology and knowledge transfer will be key.

The discussion was then opened up to cover any relevant topic and the additional points that were made are listed below

- There are alternative approaches for CCS and fossil fuels that could be considered for the future, for example have the CO₂ capture up-front to produce renewable SNG which can then be injected into the gas grid.
- IGGC piggy backs on GT technology from aerospace and industry was encouraged to take advantage of this (some key manufacturers are already doing this)
- There is still the issue of the skills gap and whether we will be able to manage it.

DAY 2 PANEL SESSION

The panel was again chaired by Philip Sharman, Chair of the APGTF and the panel members were:

Bruce Adderley	Tata Steel
Myles Allen	University of Oxford
Jeremy Carey	SSE
Mike Farley	Doosan Power Systems
John Gale	IEAGHG

The broad objectives of the panel session were to consider:

- *Whether the UK can maintain a leadership role in CCS*
- *Looking out over the next decade, what the UK must do to be amongst the leaders.*

The Chair started the session by posing the following question to the panel and then the delegates were invited to provide answers or comments as appropriate.

Is the current range of proposed Government led activities sufficient to allow us to maintain this leadership role? If not, what would have the most impact in keeping us in this position?

A variety of answers and comments were put forward from the panel and from the floor; the main points are listed below.

- Ultimately, to be up with the leaders for commercialising CCS, we either have to be the cheapest (difficult) or we have to go for differentiation
- Differentiation by going for flexibility in operation will give us a chance of leading
- At the moment, in Europe, the Dutch look as though they will be first to full-scale demonstration
- Politics/policy and finance are more crucial than technology
- 'Trillionth tonne' concept unlikely to be adopted in Europe as we are already committed to ETS. However, it may be worth pursuing for developing countries
- DECC not talking about four full scale demos anymore; instead they are talking of a programme moving to commercialisation with one demo and other 'bits'. There is a danger of 'letting politicians off the hook'
- The EMR must provide sufficient money to make CCS competitive

- If CCS got the same funding as offshore wind, then it would happen
- We need to convince Treasury that CCS is the most 'market friendly' clean technology
- From an industrial perspective, it is likely that industry will be behind power generation for significant roll-out. Again politics/policy and finance are the biggest hurdles.

The post-graduate students in the audience were then asked for their views on careers in CCS and the following comments were made:

- There does seem to be a future career to be had with CCS, particularly for good engineers
- There appears to be a need for engineering graduates across the whole clean technologies sector
- China and south east Asia look as though they are the only areas providing the numbers of (engineering) graduates that are likely to be required for the future.

The discussion was then opened up to cover any relevant topic and the additional points that were made are listed below:

- In some industries, CO₂ utilisation could make a contribution but scale is an issue
- In answer to a question 'what is meant by a technology or product being commercial', the following comments were made:
 - an OEM will offer a guarantee on 'what it says on the box'
 - the rate of return after tax, risk etc is better than the next best option
- The storage end is the highest risk and therefore needs the highest risk premium
- CO₂ into depleted gas fields can be done now
- Saline aquifers need ~10 years timeframe before they can be utilised commercially
- It is still possible to achieve commercialisation by 2020 with the right support etc and with a managed 'ramping-up' in industry
- The concern over methane leakage impacts on climate change is an unnecessary diversion.

CHAIR'S CLOSING REMARKS

The APGTF Chair thanked the speakers, panellists and delegates for making it a successful workshop and he thanked the main sponsors and co-organisers for supporting the event. The output from the workshop will be fed into the Government and other national and international funding agencies to help ensure success with CCS for the UK. Finally, the Chairman said that he hoped there would be significant progress on the main issues raised for CCS to report at next year's workshop.

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Day 1 (Tuesday 13th March): RD&D activities in the UK – a good news story

The one certainty around the development of a new industry is that it will be difficult. Given the recent disappointing news concerning the cancellation of the Longannet CCS project and the lack of clarity around the programme for future demo projects, it is easy to feel despondent about CCS in the UK. However, there remains a positive story to tell on progress being made in research, development and pilot-scale demonstration which is worth shouting about!

09:00 – 09:30	Registration and refreshments	
09:30	Welcome and introduction	<i>Philip Sharman, APGTF Chair</i>
Part 1	CCS Technology RD&D – what needs to be done and when?	
09:40	The APGTF's 2011 technology strategy	<i>Philip Sharman, APGTF Chair</i>
Part 2	UK CCS RD&D – programmes and funding updates	
10:00	The Energy Technologies Institute's CCS RD&D activities	<i>Andrew Green, Programme Manager CCS</i>
10:15	The Technology Strategy Board's CATs RD&D activities	<i>Derek Allen, Lead Technologist for Carbon Abatement Technologies</i>
10:30	The Research Councils' Energy Programme's CCS research activities	<i>Jason Green, Head of RCUK Energy Programme</i>
10:45	The Biomass and Fossil Fuel Research Alliance (BF2RA) – an update	<i>Peter Sage, Technical Officer, BF2RA</i>
11:00	Q&A and discussion	
11:20 – 11:40	Refreshment break	

Part 3	UK CCS RD&D – what is being done: large-scale activities [Session Chair: Peter Sage, CRF]	
11:40	E.ON's FEED study – a CCS systems approach	<i>Robin Irons, Technical Head, Zero Emission Power Plant, E.ON New Build & Technology</i>
12:00	Learning from DEMO1 to shape future demonstration & deployment of CCS in the UK	<i>Steven Marshall, Director, Low-Carbon Generation, Petrofac</i>
12:20	The CC100+ pilot capture project at Ferrybridge power station	<i>Matthew Hunt, CCS Sales Manager, Doosan Power Systems</i>
12:40	Q&A and discussion	
13:00 – 14:00	Lunch and poster display	
14:00	Keynote talk 1: CCS in the UK – moving things forward	<i>Edward Davey, Secretary of State for Energy & Climate Change</i>
Part 3 (cont.)	UK CCS RD&D – what is being done: large-scale activities [Session Chair: Peter Sage, CRF]	
14:10	Carbon capture pilot scale demonstration at Aberthaw power station	<i>Dorian Matts, Steam Raising Manager, RWE npower</i>
14:30	Safe CO ₂ pipeline transport – understanding the hazard and risks	<i>Rosemary Whitbread, Principal Consultant, Health and Safety Laboratory</i>
14:50	CO ₂ storage RD&D	<i>Tony Espie, Advisor CO₂ Storage, BP Alternative Energy</i>
15:10	Q&A and discussion	
15:30 – 15:50	Refreshment break	
Part 4	UK CCS research [Session Chair: Jacqui Williams, EPSRC]	
15:50	Achieving impact in CCS research	<i>Jacqui Williams, EPSRC Professor Jon Gibbins, University of Edinburgh, Professor Mohamed Pourkashanian, Uni of Leeds</i>
16:20	Q&A and discussion	
Part 5	Are priorities being addressed? Is there sufficient knowledge transfer?	
16:30	Panel discussion with speakers from the day	<i>Chaired by Philip Sharman, APGTF Chair</i>
17:30	Close	
17:30 – 18:30	Reception (hosted by the Energy Generation & Supply Knowledge Transfer Network)	

DAY 2: Towards a commercial reality....

Building on the successful UK RD&D landscape described in Day 1, how do we turn CCS into a commercial reality?

09:00 – 09:30	Registration and Coffee	
09:30	Chair's introduction	<i>Mike Farley, APGTF Vice-Chair</i>
09:40	Keynote talk 2: Building towards a commercial reality	<i>David Clarke, Chief Executive, the Energy Technologies Institute</i>
Part 6	UK strategy – priorities and initiatives for CCS	
10:00	Innovation in CCS – maintaining UK momentum	<i>Adam Dawson, CEO, Office of Carbon Capture & Storage, DECC</i>
10:20	Regional networks for integrated CCS	<i>Stephen Brown, Director, CO₂Sense</i>
10:40	Q&A and Discussion	
11:00 – 11:20	Refreshment break	
11:20	Keynote talk 3: The trillionth tonne – CCS for climate change mitigation	<i>Professor Myles Allen, Oxford University</i>
Part 7	The international scene – progress, achievements and priorities	
11:40	CCS – a European update	<i>Pierre Dechamps, Adviser to President Barroso, European Commission</i>
12:00	CCS developments worldwide including CCS in CDM	<i>John Gale, General Manager, IEA Greenhouse Gas R&D Programme</i>
12:20	Q&A and discussion	
12:40 – 13:30	Lunch and poster display	
Part 8	Other key issues for CCS in the UK [Session Chair: Judith Shapiro, CCS Association]	
13:30	Turbulent times in energy and climate policy: how is it influencing public perceptions of CCS?	<i>Simon Shackley, Lecturer in Carbon Policy, University of Edinburgh</i>
13:50	Training the next generation of research leaders	<i>Professor Colin Snape, Director of Engineering Doctorate Centre in Efficient Fossil Energy Technologies, University of Nottingham</i>
14:10	CCS for industrial sources	<i>Bruce Adderley, Manager, Climate Change Breakthrough Technology, Tata Steel</i>
14:30	Techno-economic studies of biomass to power with carbon capture technologies (ETI funded project)	<i>Amit Bhave, CEO of Computational Modelling Cambridge Ltd</i>
14:50	Q&A and discussion	
15:10 – 15:30	Refreshment break	
Part 9	Can the UK maintain a leadership role in CCS?	
15:30	Panel discussion with speakers from the day	<i>Chaired by Philip Sharman, APGTF Chair</i>
16:30	Close	