

# CARBON CAPTURE LEGAL PROGRAMME

## Carbon Capture and Storage – Does It Have A Future?

Report of a Conference organized by  
Kings College and University College  
London

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Richard Macrory

March 2014

**University College London**

**Centre for Law and the Environment, Carbon Capture Legal Programme**

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## Summary of the CCS Conference, Senate House, 6 March 2014

**Eva van der Marel, Ragnar Löfstedt and Richard Macrory**

On the 6<sup>th</sup> of March 2014, King's College, in collaboration with UCL, organised a conference on Carbon Capture and Storage (CCS) in Senate House, London. With contributions from government, industry and academia, discussions were lively, informed, and encouraged a sense of urgency to get CCS on track. The conference deliberately situated the 'CCS challenge' in the UK and in Europe within the wider debate on the UK's Climate Change Strategy, the role of government, technology choices, and public acceptability. As such, it attracted a much broader audience than is usual for many CCS events, with a lengthy waiting list.

From the outset it was recognized that that one of the difficulties we face is that of framing the various complex discussions surrounding CCS in a way fit for policy makers, and the public. One of the big challenges for the 21<sup>st</sup> century, as was pointed out during the conference, is that of clear communication. Various speakers emphasized that what is currently lacking in the UK, and indeed in Europe, is an identification by Government of the 'amount' of CCS we are aiming for. The industry needs a clear pathway to help build its confidence and encourage it to engage. Moreover, there was strong support for forging stronger alliances with other European countries to ensure the full potential of this technology. CCS to date in Europe has tended to be associated with the energy industry, but the need for other industrial processes giving rise to large CO<sub>2</sub> emissions to deploy CCS was an issue that repeatedly came up during the day. Finally, it became apparent that we must reconsider our current approach to involving the public in this process. This is an often undervalued aspect of a sound CCS strategy but nevertheless a crucial one, especially when remembering the public acceptance set-backs in other European countries. The adage 'out of mind, out of site' may be true for countries pursuing off-shore storage only, but other aspects of the CCS chain, including the laying of pipelines, may raise public sensitivities.

Speakers highlighted why CCS could be a crucial part of our energy strategy. It follows from the recent Working Group contribution to the 5<sup>th</sup> IPCC report (available [here](#)) that limiting global warming to less than 2°C since 1861–1880 will require cumulative CO<sub>2</sub> emissions from all anthropogenic sources to stay below 1000 gigatonnes of carbon (3670 gigatonnes of CO<sub>2</sub>).<sup>1</sup> However, over half of the world's carbon 'allowance' was already emitted by 2011 – probably even more than this when other warming factors are taken into account. In 2012, global CO<sub>2</sub> emissions reached a total of 34.5 billion tonnes.<sup>2</sup> Even if emission rates can be slowed down, this means that our 'allowance' is set to be exhausted soon – if it is not already.

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<sup>1</sup> This calculation has a probability of >66%. The report also includes slightly varying calculations leading to different results; however the probability level of these results is significantly lower.

<sup>2</sup> PBL Netherlands Environmental Assessment Agency, *Trends in CO<sub>2</sub> Emissions: 2013 Report*, The Hague, 2013. Available at: [http://edgar.jrc.ec.europa.eu/news\\_docs/pbl-2013-trends-in-global-co2-emissions-2013-report-1148.pdf](http://edgar.jrc.ec.europa.eu/news_docs/pbl-2013-trends-in-global-co2-emissions-2013-report-1148.pdf) (last visited on 11 March 2014)

Nevertheless, most agreed that CCS is no magic bullet – complex issues call for complex responses.

**Sir Mark Walport**, Chief Scientific Advisor to the Government, gave the first presentation. As well as setting out the Government's policy on emission reductions and climate change, and making a case for CCS, Sir Mark discussed different elements of advising the government. He pointed out that a viable policy must approach the subject from different angles, looking at issues such as security of supply, sustainability, and cost & affordability. 'Scientific fact' is only one element of this.

**Dan Byles**, MP and a member of the House of Commons Select Committee on Energy and Climate Change, provided the perspective of a politician. The Select Committee will shortly publish its report on CCS, and Dan emphasized that while recommendations of a Committee are not binding on Government, it must at least respond. He could not reveal its recommendations, but from a personal perspective Dan emphasized the need for CCS on gas-fired power stations and industrial processes as well as coal, and that it is highly unlikely that CCS will be implemented without strong political incentive. In his view, insufficient attention is being given to public perception issues, and at the very least we need a Royal Society type report which can clarify some of the basic scientific understanding.

**David Hone**, Chief Climate Change Advisor from Shell, presented two different scenarios developed by Shell. The 'Mountains' model is a top-down perspective (including stronger government involvement, centralization, etc.) which projects a downward trend for emissions from the 2030s, reaching near zero by 2100. This scenario, although not a 2°C trajectory, does stay below a 4°C rise in temperature thanks to a rapid deployment of CCS throughout the century. The 'Oceans' model (with a far more diffuse perspective on governance) is a bottom-up scenario, which projects a rapid transition to solar PV (in particular) in combination with enhanced energy efficiency measures driven by higher energy prices. Because of the late inclusion of CCS in the energy portfolio, cumulative CO<sub>2</sub> emissions in the Oceans scenario exceed those projected for the Mountains scenario.

In the second session, chaired by Tom Burke CBE, the importance of looking at cumulative emissions (carbon stock) rather than yearly output was explained in more detail by the geologist **Prof. Stuart Haszeldine** of the University of Edinburgh. Stuart gave an overview of the scientific backdrop to why we need CCS, but explained that while CCS on its own may be a good step in the right direction, it is still highly probable we will go past the limit of our carbon 'allowance'. The only options are to either completely step out of coal and/or take carbon out of the atmosphere (CO<sub>2</sub> capture from air and storing it e.g. underground or in minerals). Stuart then proceeded to challenge a number of misconceptions surrounding the 'lack of safety' of storing CO<sub>2</sub>, including underground pressure, earth tremors and leakages – all of which can raise public perception issues. Stuart also suggested that one should impose tax at source on extraction rather than at the point of emission, as an incentive for CCS deployment: e.g. for each tonne of carbon extracted, one 'tonne of CCS' would have to be provided in order to avoid a hefty carbon tax.

**David Kennedy**, Chief Executive of the Committee on Climate Change, explained that the UK government needs to commit to its decarbonisation targets by deciding on a medium term strategy in conjunction with what other countries are doing (this should include the commercialisation programme, which is lacking in the UK for the period following the two demonstration projects). This is not a challenge which can be solved by this government prior to the upcoming elections. David also pointed out that some questions remained when thinking about a strategy for CCS in the UK, including (a) the storage capacity available in the UK (relative to the power sector emissions) and (b) the carbon intensity of CCS, especially coal CCS, over its whole life cycle. In response to a question from the panel chair, he felt that the Government was rather stuck in a 1990's free market approach of avoiding picking on technologies – it might be preferable to focus on three or four technologies, and say what should be done about them.

Whilst a new UK government may eventually provide new opportunities, the current lack of a business model for CCS could be resolved by more strategic thinking, and learning from mistakes made. **Chris Littlecott** from E3G argued that the fundamental problem in the EU is that of the 'overly simplistic' mental model used for incentivizing CCS. After an initial demonstration phase, the EU sought to let carbon pricing do most of the heavy lifting in terms of incentivizing CCS. When the carbon price started dropping it became apparent that this model is based only on avoiding a *future* cost of CO<sub>2</sub>. This made for a weak business case. Another problem with the EU's mental model is that the rewards from the EU ETS are relative to the price of CO<sub>2</sub>. Lignite and coal are therefore most incentivized to start developing CCS first, followed by gas, and only lastly industrial projects. The most interesting business case suggested so far, according to Chris, has been that of introducing a CCS target with CCS Certificates. An entirely different picture emerges when looking at some of the projects going ahead in other countries. Those forging ahead are either heavy coal users, aiming to protect their fleet, or countries where there is a market for CO<sub>2</sub>. To a certain extent, the UK has picked up on the absence of a business case and now offers such projects Contracts for Difference (CfDs). Digging into the details, however, it seems that CfDs for CCS leave much to be desired - whilst there is an allocation model under the CfDs for renewable energy there is none for CCS, for example.

The third session, chaired by Prof. Richard Macrory from UCL, focussed on legal and regulatory issues. **Jerzy Jendroska**, a leading Polish environmental lawyer, discussed how the EU CCS Directive had been introduced into Poland. This has now finally been completed (click [here](#) to read Jerzy's in-depth report on Polish CCS laws). Poland decided to implement the EU CCS Directive by amending existing mining legislation, rather than enacting a new, stand-alone piece of legislation which added to complexities and explained the delays in transposition. An important question during this process was whether the CCS framework should be limited to demonstration projects only or also cover commercialised projects. The CCS Directive leaves the Member States the discretion to decide whether or not to actually allow for storage in practice, but it remained unclear whether limiting the scope of national provisions (e.g. to demonstration projects only) would amount to incomplete

transition of the Directive under EU law. The Polish government therefore sought the Opinion of the European Commission which, within 2 months, came back with the answer that countries can indeed limit their CCS legislation to demonstration projects (click [here](#) for the Commission's letter). As of 24 November 2013, 2 years after the implementation deadline, Poland now finally has a legal framework for CCS, but ironically the Government has put a hold on its CCS implementation strategy, largely it seems for economic reasons.

**Ian Havercroft** from the Global Carbon Capture and Storage Institute talked about how the EU model for CCS compares to that of other countries. The European Union was a first mover in passing an dedicated CCS law, covering capture, transport, and storage. Other early movers include Australia (onshore, offshore and project specific legislation), the US (Federal legislation on CO<sub>2</sub> storage, as well as State led law) and legal developments at Provincial level in Canada, led by Alberta. There is now second generation legislation where legislative activity is not limited to developed nations, and there is a particularly strong interest in CCS in the Asia-Pacific region. Examples include Japan, Korea, South Africa, Malaysia, China, Taiwan, New Zealand, Indonesia, Mexico and Trinidad and Tobago. Ian developed criteria for assessing CCS legislation including: the consistency, scope and breadth of the CCS-specific framework; the existence of secondary legislation or subsequent amendments to wider legislative models; the status of implementation; the provision or development of secondary guidance; a broader legal and regulatory support for the technology; and countries' signatory to international legal commitments for CCS. With respect to the EU Ian concluded that the wider perception is that the EU has lost its project leadership position, and that the financial crisis and political opposition in some Member States have greatly impacted ambitions for the technology within the EU. Nevertheless, he pointed out that the EU remains one of the leaders in the legal and regulatory space, with widespread praise for many features of the EU regulatory regime, strengthened by firm support from the Commission and several Member States, and incorporating an on-going process of re-evaluation and development.

From the perspective of the Crown Estate, **Ward Goldthorpe** discussed the longer term strategies for off-shore storage in the UK. Ward first of all explained the Crown Estate's role in enabling CCS and gave an overview of the permitting regime applicable off-shore. This overview also addressed the –often overlooked– issue which arises when multiple and competing activities take place off-shore. This creates specific issues for the Crown Estate, which aims to co-locate activities with leases. Challenges which arise in this context include access to storage sites; sub-surface interference; and pressure interference, e.g. with nearby oil fields.

In terms of a long-term strategy, Ward noted that the UK Cost Reduction Task Force has indicated, and it is very well known, that economies of scale create cost reduction (whether improvements in capture or off-shore facilities). The cost-reduction pathway for the UK CCS sector must therefore be through economies of scale. However, Ward emphasized the point raised in the morning session that industry needs to know the scale of CCS that the country wishes to achieve, and discussed a number of options for infrastructure. Bankable storage solutions could take the shape of in-field or near-field appraisals and using depleted or near-

depleted fields. Viable business structures should consider the potential for using shared facilities with the oil and gas industry, smart CTS design and enabling service contracts. Ward emphasized ‘no regrets’ actions such as Enhanced Oil Recovery (EOR), future industrial decarbonisation, and re-use of infrastructure. Different actors need to undertake different actions – for example, the UK Government (electricity market reform, R&D funding, additional support for transport and storage), Crown Estate (facilitating smart design, auctions, and options contracts, etc.) and industry (mixed CCS and EOR projects, collaboration and co-ordination, insurance pooling, etc.).

The important question of public perception and engagement was addressed in the final subject session, chaired by Prof. Ragnar Löfstedt. **David Reiner** from Cambridge University and the UK CCS Research centre pointed out that surveys on public knowledge of CCS are not giving a positive picture, and argued that little has been done on the ‘supply side’ of communicating to the public. Few websites exist to inform the general public, and the level of information available varies greatly. Conventional illustrations of CCS (such as that on Wikipedia) fail to represent true scales. Many ignore certain elements of the CCS chain, such as transport, entirely – odd, given that it is pipelines which will probably affect most members of the public. Finally, survey after survey shows a lack of trust in industry and government. Unsurprisingly, these are also the main groups conveying information to the public with scientists, generally the most trusted source, convey the least.

**Dag Erlend Henriksen** and **Ingvild Ombudstvedt**, from the Norwegian law firm Arntzen de Besche, addressed the development of CCS in Norway. Public confidence has not been an issue on Norway and while it is true that all storage will take place off-shore, there also seems to be a general acceptance of CO<sub>2</sub> storage simply as the CCS industry shares some of its features with the lucrative oil industry. Interestingly, public confidence has not been noticeably affected by the termination of the ‘Moonlanding’ project in Mongstad. Lessons which can be learned from this failure is that it is important to ensure funding throughout the whole project; to choose the ‘right’ project from the start and carefully select the ‘right’ partner – three elements which indeed made Mongstad unsuitable. Dag and Ingvild outlined the CCS projects on their way in Norway, and emphasized that TCM at Mongstad will still continue to serve as a highly successful test centre for different technologies. Norway’s success to date is not linked to government funding alone. Whilst ‘commercialization’ is not an issue, there is an emphasis on the importance of private party cooperation. Moreover, it has been acknowledged that it is key to have clearly stated responsibilities and liabilities from the outset, in the agreement between the CCS operators and the authorities.

**Wandi Bruine de Bruin** of the University of Leeds discussed risk perception and communication in the field of CCS. As to effectiveness, she argued that communications should be balanced, come from different perspectives and include interviews and surveys. Qualitative interviews should be conducted at an early stage to find out what kind of wording people use and how one can best engage with them. There is the problem of having to provide ‘some’ basic information first, given the general total lack of knowledge on CCS. Wandi illustrated this with her own research on the topic. Her work concluded, inter alia, that

people sometimes like CCS *less* after receiving more information about it, often due to misconceptions. Importantly, this is not specific to CCS. Wandri's and her colleagues' research showed that, when given risk-benefit information about one technology, people tend to focus on the negative. It is important, when carrying out surveys on CCS, to provide risk-benefit information about other technologies too, as well as informing people about realistic energy portfolios.

In the final discussion session 'Where Do We Go from Here?' **Tim Bertels** from Shell gave an optimistic talk about the CCS developments which *are* taking place, despite all obstacles and the negative economic climate. The Peterhead project in the UK has been awarded funding for a FEED study, and together with the White Rose project this will provide opportunities for learning. Moreover, it is clear that there are no significant technological barriers left for CCS. Second generation CCS technology is already being developed and will bring the cost down, and there is growing awareness among industry and the government that it is crucial to communicate the necessity of CCS in the energy mix.

**Jeff Chapman**, Emeritus President of the Carbon Capture and Storage Association, continued on that now is the time to get a flow of projects going. Contracts for Difference under the Electricity Market Reforms, though a good step forward, will not in themselves solve the problems. Jeff emphasized that competitions are not necessarily helpful - 17 projects have been developed at various stages in the UK at huge costs, whilst only a few have been awarded final funding. It would be more lucrative to learn from other technologies, such as nuclear. With regard to new nuclear, the government has decided on 6 potential sites, now allowing the owners of those sites to negotiate terms with the government.

Finally, **Ashley Ibbett** from DECC referred the Reduction Task Force Report and pointed out that the issue was not one of the technological challenge. The UK is well underway with the Peterhead and White Rose projects, but what we now need to establish is the actual cost of CCS. This can then feed into a new commercial strategy, since the biggest challenge for CCS is, indeed, of a commercial nature. Despite the optimism from a UK perspective, he noted that it was currently 'lonely' in Europe and it would help to have more positive support from other Member States.

**Stuart Haszeldine** provided a final summary of the lessons learnt from the day. First of all, the UK needs 'friends'. There are only 3 countries in Europe are seriously developing CCS – we need to work through Europe and engage other Member States. Secondly, we need to find a way of presenting the financial side differently. The UK Government can be volatile and it is a risky situation if one of the levers for CCS may disappear at any time. What is missing is the 'greed incentive', the real profit for big commercial operators. Finally, we need to get a flow of projects going. If anything has become clear by now, it is that investing in CCS is a no-regret strategy.



## **Appendix 1 – Programme for ‘Carbon Capture Storage: Does it have a Future?’**

Co-organisers: Professor Ragnar Löfstedt, King’s College London and Professor Richard Macrory, University College London

Senate House, University of London

6 March 2014

*The purpose of the conference is to assess the current state of play on CCS with a focus on the UK within a European context. From an optimistic picture a few years ago, CCS in Europe appears to be stalling. The conference will examine the reasons for this within the wider policy, economic, regulatory and public perception contexts, and assess likely ways forward*

### **9.15 Registration and coffee**

### **9.45 Welcome - Richard Macrory UCL and Ragnar Löfstedt, KCL**

#### **10.00 Session I - The Broad Picture**

CCS and Government Policy

Sir Mark Walport, Chief Scientist, UK Government

The Committee Reports on CCS

Dan Byles MP Member House of Commons  
Select Committee on Energy and Climate Change

The Industry Vision

David Hone, Chief Climate Change Advisor,  
Group CO2 Shell

#### **11.00 Break**

#### **11.15 Session II - The Policy Context of CCS** chaired by Tom Burke CBE

The current state of play on CCS in the United Kingdom

Prof Stuart Haszeldine, University of Edinburgh

*What is the current state of play of potential CCS projects? What is the potential off-shore capacity for storage? What do we know and not know about the engineering and science?*

David Kennedy, Chief Executive, Committee on Climate Change

*What are UK’s climate change obligations? What are the time-scales and scenarios? What role could CCS play? Is unabated gas consistent with the obligations?*

The Economic Context Chris Littlecott, E3G

*What changes will Electricity Market Reform bring? What is the current state of play? Will this be an economic game-changer for CCS? What impact are reforms of the EU emissions trading system likely to make?*

Panel Discussion and questions:

Dr David Joffe, Committee on Climate Change

Prof Stuart Haszeldine, University of Edinburgh

Chris Littlecott, E3G

### **13.00 LUNCH**

### **14.15 Session III - Legal and Regulatory Issues** chaired by Professor Richard Macrory

The Global Context Ian Havercroft, Global Carbon Capture Storage Institute

*Is Europe still a leader in regulatory design for CCS? What are the key developments in other jurisdictions? Are there useful lessons to be learnt?*

Off-shore regulation in the United Kingdom Ward Goldthorpe, Crown Estate

*What is the role of the Crown Estate? What are the longer term strategies for off-shore storage? How does one resolve competing uses?*

Poland and CCS Jerzy Jendrośka, Adjunct Professor of European and International Law at Opole University

*How was the Directive implemented in Poland? What challenges in legal design emerged? Is public opinion an issue in Poland? Why has CCS stalled in Poland?*

### **15.15 Break**

### **15.45 Session IV - Risk Communication and public engagement** chaired by Prof Ragnar Löfstedt

David Reiner, University of Cambridge

*How does one best engage the public on new technologies? How effective has the CCS community been? Are there lessons for the future?*

Dag Erlend Henriksen and Ingvild Ombudstvedt, Arntzen de Besche

*The do's and don'ts- A Norwegian experience of state involvement in CCS - the Mongstad Project. How does this affect public confidence in CCS?*

Wandi Bruine de Bruin, University of Leeds

*Risk perception and communication about CCS*

Panel Discussion and questions: The speakers

### **17.00 Where do we go from here?**

Panel Discussion and questions led by Session Chairs: Tim Bertels, Head of CCS, Shell, Jeff Chapman, CCSA and Ashley Ibbett, DECC

### **17.40 Closing remarks** by Stuart Haszeldine

## **Appendix 2 – Delegate List for ‘Carbon Capture Storage: Does it have a Future?’**

1. Benita Ainsworth, LLM Student, UCL
2. Robert Amos, Research Assistant, UCL
3. Tim Bertels, Head of CCS, Shell
4. Frances Bodman, Lawyer, Client Earth
5. Richard Briant, International Director, Said Business School (University of Oxford)
6. Tom Burke, CBE Environmental Policy Adviser, Rio Tinto Plc
7. Dan Byles, MP and Member of the Energy and Climate Change Select Committee, House of Commons
8. Claire Carter, PhD Researcher, University of Sussex
9. Dr Jeff Chapman, Emeritus Director, Carbon Capture and Storage Association
10. Jonathan Church, LLM student, UCL
11. Chris Clarke, Hon Research Fellow, UCL
12. Prof. Wandu Bruine de Bruin, Professor of Behavioural Decision Making, University of Leeds
13. Marguerite de Chaisemartin, LLM student, UCL
14. Amir Dhillon, LLM Student, UCL
15. Aderinsola Fagbure, Student, UCL
16. Yuwen Fan, PhD student, UCL
17. Linda Farrow, Executive Director, UKELA
18. Dr Ward Goldthorpe, Programme Manager, Crown Estate
19. Dr Tony Grayling, Head of Climate Change and Communities, Environment Agency

20. Ioanna Hadjiyianni, PhD Student, Dickson Poon School of Law King's College London
21. Dr Phil Hare, Vice President, Poyry Management Consulting
22. Prof Stuart Haszeldine, Professor of CCS, University of Edinburgh
23. Ian Havercroft, Senior Advisor, Global CCS Institute
24. Marjoke Heneweer, Toxicologist, Shell
25. Dag Erlend Henriksen, Partner, Arntzen de Besche
26. Stephen Hockman, Head of Chambers, Six Pump Court
27. David Hone, Chief Climate Change Advisor, Group CO2 Shell
28. James Hunt, Global Low Carbon Lead, Xodus Group
29. Ashley Ibbett, Director & Chief Executive, Office of CCS, DECC
30. Dr Rachael James, Reader in Marine Geochemistry, University of Southampton
31. Dr. Jerzy Jendrońska, Managing Partner, Jendrońska Jerzmanski Bar & Partners
32. David Joffe, Senior Analyst, Technology & Energy Systems, Committee on Climate Change
33. Zoe Kapetaki, Knowledge Sharing Adviser, Global CCS Institute
34. Dr David Kennedy, Chief Executive, Committee on Climate Change
35. Dr David Langlet, Research Fellow, Faculty of Law, University of Oxford
36. Dr Philip Lightowers, Writer
37. Theo Lister, LLM Student, UCL
38. Chris Littlecott, Senior Policy Advisor, E3G
39. Prof Ragnar Löfstedt, Director, King's Centre for Risk Management, King's College London
40. Prof Richard Macrory Director, Carbon Capture Legal Programme, UCL

41. Robbie Macrory, PhD Student, Institute of the Americas, UCL
42. Alex Marshall, Political reporter, ENDS
43. Chris Mayne, LPC student/Future Trainee Eversheds
44. Sean McCoy, Energy Analyst, International Energy Agency
45. Dr Ben Milligan, Research Associate, UCL
46. Ingvild Ombudstvedt, Associate, Arntzen de Besche
47. Holly Page, Research Assistant, Imperial College London
48. Dr Graham Parsons, President, Organisation for Western Economic Cooperation
49. Angus Paxton, Principal, Poyry Management Consulting
50. Derek Reay, Team Leader Energy & Minerals, Geological Survey of Northern Ireland
51. Dr David Reiner, Senior Lecturer in Technology Policy, University of Cambridge
52. Dr Eloise Scotford, Lecturer, King's College London
53. Hugh Sherlock, Boom Operator
54. Claire Swadkin, Policy Advisor, Shell International Ltd
55. Ugo Taddei, LLM Student, UCL
56. Eva van der Marel, Research Assistant, Carbon Capture Legal Programme, UCL
57. Eiji Wakiwaka, Program director, Clinton Climate Initiative
58. Sir Mark Walport, Chief Scientist, UK Government
59. Viktor Weber, PhD student & Participant in the ECO2 project, University of Southampton
60. Dr Paul Zakkour, Director, Carbon Counts