

DECC consultation

A framework for the development of clean coal

Submission by the Energy Institute

September 2009

Introduction

The Energy Institute (EI) is pleased to make the following submission to DECC's a framework for the development of clean coal consultation. This response is a summary of the views and evidence presented at (and subsequent to) an expert workshop organised by the Energy Institute on 30 July 2009.

The EI is the professional body for the whole energy industry. It has a membership of over 14,000 individuals and 300 organisations and provides an independent focal point for the energy community, bringing together industry, academia and Government. The EI's purpose is to promote the safe, environmentally responsible and efficient supply and use of energy in all its forms and applications. In fulfilling its purpose the EI can address a wide range of topics in detail, from upstream and downstream hydrocarbons and other primary fuels and renewables, through power generation, transmission and distribution to sustainable development, demand side management and energy efficiency.

As a charity incorporated by Royal Charter with membership across the full range of the energy sector, it is not appropriate for the EI to promote specific technologies or options. Instead we seek to assist the policy process by helping clarify the key issues and by improving the evidence base on which decisions will be made. This submission reflects the views of carbon capture and storage specialists within our membership and where useful, notes divergence of opinion.

Introductory key points

Key introductory points made by EI members on this consultation can be highlighted as follows

- The consultation is welcomed and DECC praised for the work done so far on Carbon Capture and Storage (CCS). Coal is seen to continue to make a valuable contribution to UK and global energy systems for many years to come, but the imperatives of climate change and the need to decarbonise those systems mean that this can only be with CCS.
- Overall, the clean coal framework should be set more strongly in the wider context of greenhouse gas emissions reductions, and specifically the Committee on Climate Change's assertion that grid-based electricity supply should be largely de-carbonised by 2030 (<100 gCO₂/KWh), with clear milestones along the way (e.g. 300g CO₂/KWh by 2020).
- The scale and urgency of this challenge means clean coal plans should be more ambitious – recommendation is that at least 4 commercial-scale demonstration projects be funded and operational by 2016, with plans for further deployment by 2020. Getting capacity built quickly is essential for long-term cost reduction.
- Given the range of economic, environmental and energy security benefits arising from the rapid development and deployment of CCS, there is a strong case for initial Government financial support, including for UK-specific transport and storage infrastructure. This should be viewed as strategic future investment.
- There is concern that the current proposals risk an over-reliance on the EU ETS – it will not provide investor certainty in the crucial period to 2016, but may not thereafter either. While it is important that UK actions be compatible with the ETS, and can benefit from it if the carbon price rises substantially,

it is also necessary to build in contingencies to ensure, for example, that emissions are reduced and electricity supplies are decarbonised in line with UK requirements (as set out clearly by the Committee on Climate Change), which may well mean deeper and faster cuts than those deriving from the ETS on its own, particularly in the electricity supply sector. While it is possible that at some point in the future the costs of CCS will have come down (aided by lessons learnt during the demonstration phase), and the carbon price gone up (aided by tightening emissions caps) such that CCS is viable in the carbon market, there is at present a funding gap that needs to be filled by mechanisms outside the ETS.

- Much of the current focus is on the demonstration projects and new build, leading to insufficient attention being paid to the issue of retrofitting (new and existing), especially what plants, what technologies and how it will be funded. Without clarity over funding for the whole plant (including future retrofit), there is a serious risk that investment in the UK for new coal stations will not happen and companies will go elsewhere.
- There is also concern that there is insufficient attention in the proposed framework to the international context for CCS, including the potential for the co-ordination of demonstration and deployment plans to facilitate cost-effective technology development as quickly as possible.

Below are the responses to specific questions within the consultation document

Chapter 3: the proposed framework for the development of clean coal

Question 3.1 What are your views on how effective the proposed framework of financial and regulatory measures will be in supporting delivery of our vision for clean coal at home and abroad?

Question 3.2 How do you think the proposals might impact on decisions to invest in new coal power stations and CCS demonstration in the UK? How can this framework best be developed to encourage investment in coal and CCS in the UK?

The Public Private Partnership (PPP) model has been used successfully in other areas (e.g. schools, hospitals and road building) and is likely to be the best option for CCS investment. It would be sensible, however, to make separate arrangements for capture, transport and storage to reflect the differing market conditions and risks in these three distinct sectors and the different industry models (acceptable risk/return) for companies likely to be active in each part of the CCS chain.

Risk sharing between the private and public sectors should be on dispatch, energy prices, planning and the long-term (storage and monitoring) liabilities.

The perception is that the UK currently is a relatively attractive place for CCS investors; but the Government needs to translate its initial words of encouragement into strong, clear and well-funded market signals to maintain this position. Other countries and regions (e.g. Alberta) are making rapid progress and developing frameworks that are more attractive to investors than the UK proposals.

Placing too high a cost burden on clean coal investors is likely to drive investment to gas instead – too high a reliance on (mainly imported) gas is not desirable from an overall energy security perspective, and is likely to leave the UK vulnerable to large and unpredictable energy price fluctuations.

Major energy system investments tend to only happen when there are big profits to be made (e.g. North Sea) or where regulations force them (e.g. Flue Gas Desulphurisation). There is currently little prospect of big profits from carbon capture, so regulatory compulsion (coupled with appropriate transitional funding) is the much more appropriate option for CCS. In a fragmented market, but with no time for delay, it is imperative also that Government attention be paid to the issue of skills, specifically the ramping up of the engineering skills capacity needed to deliver, operate and maintain major CCS investments. Indeed, there are major skills gaps looming across all low-carbon technologies which the Government need to address as matters of priority.

Existing market arrangements tend to favour short-term economics over longer-term strategic issues such as security of supply, availability and carbon emissions. Market mechanisms to put a value on security of supply and availability should be considered, to further help clean coal investors, as should providing a value (over and above EU ETS) for low carbon energy.

Capture technology development is international, and incremental improvements in technology are likely to happen without UK Government involvement, but developing transport and storage infrastructure are local issues. It should also be noted that the UK may be in an almost unique position (certainly one of a very few) to accelerate CCS development. For example, the UK has significant offshore oil and gas experience and a window of opportunity to utilise sub-sea storage infrastructure. Many UK plants use relatively large proportions of internationally traded fuel (and, hence, it can make sense to build plants near the coast, leading to relatively short runs of onshore pipeline) so the public acceptance dialogue is likely to be very different to many other countries here, too.

The liberalised, highly competitive energy market is, however, not good at funding R&D, nor initial commercial-scale deployment of new technologies. In fact, internationally co-ordinated Government support may be needed to reflect the long-term societal benefits of the investment (for CCS, these could include cost effective climate change mitigation, energy security and energy price stability benefits). To further manage their risks, investors will also need to have a view on the contingency regime now if they are to make investment decisions now.

Question 3.3 What are your views on the proposed objectives of the UK CCS demonstration programme, including the scale of individual demonstration projects?

While there is support for the objectives described in the framework, the recommendation is that a more fundamental overall objective be stated, namely to develop the capability for widespread (but not necessarily universal) deployment of CCS early in the 2020s, if it is technically and economically proven, to fit in with the 2030 decarbonisation of electricity supply aim implied by many of the scenarios explored by the Committee on Climate Change in their first report in December 2008, and the Climate Change Act requirements to reduce overall emissions by 34% by 2020 and 80% by 2050. To achieve this demands greater ambition, not just for the number of projects (the recommendation is at least 4 by 2016), but also for the scale of those projects, e.g. an 800MW pre-combustion plant.

The UK demonstration programme and objectives should be timed to fit with EU support mechanisms, e.g. the availability of ETS allowances and the EU Economic Recovery Package.

Our experts believe there is plenty of scope for having four 300-800MW units deployed by around 2015/16. They then suggest a further phase of demonstration projects for the period 2016-2020, to showcase other promising next generation technologies that have by then reached sufficient maturity to warrant commercial scale demonstration. The urgency of mitigating the risk of dangerous climate change means that delaying the development of reasonable/good solutions in the hope that a perfect solution is just around the corner is probably unwise. Funding mechanisms for the second phase demonstration programme will need to be considered well before 2016.

Another important objective for the UK demonstration programme should be to enable shared infrastructure to be put in place, thereby facilitating follow-on CCS projects.

Question 3.4 What are your views on whether and how an emissions performance standard (EPS) could support our policy objectives?

Unlike other forms of regulated emissions, carbon dioxide has no direct adverse local impacts in the vicinity of the individual plant, so a portfolio approach that limits overall emissions from a set of plants (again in the context of the 2030 decarbonisation of grid electricity aim) is more sensible than a blanket requirement affecting each individual station. Whilst the EU ETS has a clear role in this regard, additional UK mechanisms to reduce electricity-sector emissions further and faster than the ETS dictates are likely to be needed. It should be noted, however, that this approach can only lead to a global reduction in greenhouse gas emissions if credits that would have allowed additional emissions from other installations within the ETS cap are retired, not sold in to the carbon market.

If EPS is chosen as an appropriate policy measure to encourage use of CCS, it should be part of a long-term strategy to see widespread deployment of CCS, ensuring a balanced generation portfolio for security of supply combined with an ambitious approach to emission reduction. This should be seen in the context of all low carbon technologies and overall carbon reduction targets. EPS alone will not ensure deployment of CCS; if applied at an inappropriate level it could discourage new power plant investment and/or encourage an over-reliance on gas, and it must be applied alongside a robust financial incentive that fits into a holistic market and policy landscape.

For example, a company-wide, UK portfolio EPS would allow some high-carbon plants to remain on the system, but only if other much cleaner plants are included in the portfolio, and thus delivering overall emissions (per delivered MWh) within the limit. While such a scheme could usefully incentivise and encourage various forms of centralised, low carbon electricity, including CCS, nuclear and some renewables, it should be designed so as not to have unwanted perverse effects. For example, further work is required to identify how biomass might be used most effectively and whether any Government intervention in this decision is appropriate. Biomass co-firing at large coal-fired plants, dedicated medium size biomass-only plants and more local use which may be better suited to CHP applications are all possibilities. Different organisations and individuals have made different, and sometime conflicting, recommendations on which of these approaches (or others) represents best use of this valuable limited resource.

Chapter 4: The proposed regulatory framework

Question 4.1 Do you agree, in principle, that new coal power stations should be required to demonstrate CCS?

There is agreement in principle that new coal power stations should be required to demonstrate CCS, but as part of a programme of joint Government and Industry funded investment in the strategic development of CCS capacity and infrastructure, not simply to prohibit unabated coal-fired generation (which would actually just move investment to gas-fired plant instead).

Question 4.2 What additional planning conditions do you think an operator should have to meet to show that they would be able to meet a requirement to demonstrate CCS?

The planning requirements on potential investors are already onerous. The recommendation is that the Government should consider a National Planning Statement on CO₂ transport and storage infrastructure to help speed up that part of the planning process.

Question 4.3 What are your views on the best approach to monitoring the operation of CCS demonstrations?

Monitoring requirements are already in place for the EU ETS and under other environmental legislation, so it makes sense to utilise those protocols as far as possible to verify carbon dioxide storage. The Environment Agency already issues Environmental Permits for new plant applications, which include annual reporting requirements, and requirements for monitoring the CCS demonstration and progress towards retrofit could be included in this.

To facilitate international knowledge sharing, the public reporting proposals outlined in the framework should not only be used for UK demonstration projects; some form of standard reporting format should be adopted for overseas projects, where possible, too. There is a role for the UK Government to encourage the development of such a standard.

Question 4.4 Under which circumstances would you consider it acceptable and/or necessary for power station operators to switch off the CCS chain?

In general, the principles that underpin the concept of a "reasonable and prudent operator" should rightly determine when it would be considered appropriate and/or necessary to suspend the operation of the CCS chain. Allowing outage time for new CCS developments to be fitted and commissioned, at times of emergency grid supply shortages and when otherwise appropriate for safety or environmental reasons is recommended.

There may also be a case for allowing power stations to continue operating during unplanned outages to resolve any ‘teething problems’ for demonstration units, providing that these periods are not excessive. Although this would need to be carefully monitored to ensure ‘fair play’, it is likely to be helpful to establish general guidelines from the outset, rather than developing an ad-hoc, and possibly inconsistent, approach as projects develop. Clarity in this area should also help investors and other relevant stakeholders more accurately assess the risks associated with CCS developments.

Question 4.5 Do you agree that new coal power stations should be required to cease operation if the operator cannot demonstrate that they are making reasonable efforts to operate the CCS chain?

A power station should only be allowed to operate without CCS if the overall emissions from the operating company’s generation portfolio are within set limits (set to achieve grid-based carbon intensity of <100 gCO₂/KWh by 2030). It is imperative that emissions savings over and above those required by EU ETS are not allowed to be traded within the ETS, as that would simply mean those emissions being produced somewhere else.

The suggestion is that other ownership and licensing options for capture plant be explored. One suggestion arising at the workshop (from EI member Nicholas Perry) was for the licence terms to include ‘step-in rights’ for a competent third party to own, manage, expand and run the capture plant, charging its carbon capture services to the power station operator, in the event that the latter is unwilling or unable to do so. This could mitigate the otherwise potentially unacceptable contingent liability for mandatory retro-fitting investment, which would undermine the attractiveness for power plant developers of investing in new coal plants with demonstrator projects (see Question 4.6 below).

Question 4.6 Do you agree, in principle, that there should be requirement to retrofit?

A company-wide UK portfolio approach will probably mean some plants have to be retrofitted, but it is not believed sensible to require mandatory retrofitting to all if overall emissions are still within acceptable limits without such a requirement. Compulsory, unfunded retrofitting to all (new) plants would also act as a major disincentive to investors, who would be strongly averse to taking on such unquantifiable future liabilities.

Question 4.7 What are your views on the criteria that should form the basis of an assessment of when CCS is technically and economically proven?

Question 4.8 Do you agree that the Environment Agency should be tasked with assessing when CCS is technically proven?

Question 4.9 Who do you think should be tasked with judging when CCS is economically proven?

Question 4.10 Should the decision of when CCS is proven be one for an independent body to take, or for Government on the basis of independent advice?

The framework needs to distinguish clearly between economically and commercially proven. Private companies will only choose to invest if the likely returns and cost of capital are attractive relative to other options, and the treatment of these factors will vary between different parts of the CCS chain (capture, transport and storage sites) and between different companies with differing costs of capital and varying abilities to pass costs onto their customers.

The assessment that CCS is “proven” should be set in an international context – for capture technologies, if a specific technology can work elsewhere, it is likely to be workable here, too. For storage and transport, of course, the route and site-specific issues will be more important, and the capability, capacity and costs of the transport infrastructure will also be more UK specific. It is also likely that proving the long-term effectiveness of any storage systems will take much longer than the capture and transport phases; the criteria will need to be designed to be flexible enough to account for such variations and not to slow down the overall development of the CCS chain.

Technically CCS is already close to proven; while some technical issues remain to be fully demonstrated, particularly integrating the various CCS components and systems, most of the demonstration and deployment barriers are regulatory and economic.

Proving the economics of CCS depends on the fiscal and market framework – the Government and market regulators should consider changing the framework to make CCS economic, not just wait for it to be economic in the existing framework.

Potential tests of economics could be that the costs of doing it are cheaper than the costs of other existing low carbon energy system mechanisms and technologies, that the costs are now well defined and give CCS a reasonable position in appropriately structured cost-abatement curves (on a cost per tonne of carbon abated basis), or that the costs (on the same per tonne of carbon basis) are in line with forward projections for the ETS carbon price.

The International Energy Agency (IEA) is another possible independent reviewer of whether CCS is proven. There is no reason in principle why the Environment Agency, Committee on Climate Change, and the IEA could not all be asked to provide independent assessments of the current state of CCS development, each from their own differing perspectives.

Question 4.11 Do you agree that the Environment Agency should implement any requirement to retrofit CCS through the Environmental Permitting regime?

The Environment Agency could be well placed, but it needs to be properly resourced if it is to take on this new role since it would need to develop additional CCS-specific knowledge and expertise.

Question 4.12 What are your views on how the requirement to retrofit should apply to existing coal power stations?

The belief has already been stated that a (e.g. company-wide) UK portfolio emissions limit will ensure sufficient flexibility for existing station operators within a regime of tightening emissions per unit of output in line with the 2030 decarbonisation aim. The main issue with retrofitting that the Government needs to address is how it will be financed.

Question 4.13 Do you agree, in principle, that there is a need for a contingency measure?

Question 4.14 Do you agree that decisions about the introduction and design of any contingency measure should be subject to an independent review that would report in 2020?

Question 4.15 Which aspects of any contingency should be defined through a review, and which should be defined now?

There is a strong belief that the review needs to be carried out well before 2020. 2016 would be better, to fit in with EU ETS review. It is also important that this review covers whether and at what level further incentives for initial rollout and second phase CCS demonstration projects would be appropriate (e.g. if the deployment of renewables and/or nuclear are falling short of targets). If the carbon price is still not high or certain enough, additional economic/fiscal measures may be needed (for example, the Sleipner investment resulted directly from a Norwegian tax on carbon emissions).

There is a good case for Government to show how serious it is about CCS now by setting out the contingencies and what they would do if they arise. Investors need reasonable certainty on what the contingency penalties might be for them to be able to quantify risks and make decisions. However, imposing excessively stringent contingency measures, while providing the Government with an extra safety net, may increase the perceived risk for companies sufficiently to stop them investing in the UK (despite the Government funding). Thus, there is a delicate balance to set between the framework's incentives and contingency measures.

Contingencies include: CCS costs are very high (even relative to other technologies like nuclear and off-shore wind), investment in gas is much more attractive than coal (risking an over-reliance on gas), carbon price too low, carbon price too uncertain and political instability/inconsistency.

Chapter 5: Funding a UK CCS demonstration programme

Question 5.1 What are your views of the proposed mechanism for providing financial support to CCS demonstration projects? Does it strike the right balance between attaining value for money from public funding while addressing the needs of potential investors? Do you agree with our initial view that a CfD is the most appropriate model for a disbursement mechanism?

Question 5.2 What are your views on the proposed arrangements for selecting and managing CCS demonstration projects? Are there any additional or alternative arrangements we should consider?

Given the urgency of task (to get at least 4 projects by 2016), it is suggested that there should be one competition for at least 3 more projects, not 3 separate competitions.

Some projects are already well advanced so Government should consider pre-selection (e.g. Teesside & Hatfield) so they can progress quickly, including if some form of Member State support is ultimately required for UK projects to qualify for funding from European programmes.

There is a need to ensure the disbursement mechanism gives due reward for risk and helps build a strategic transport and storage infrastructure. There is a strong case for considering incentivising different parts of projects (capture, transport and storage) with separate, but linked, mechanisms, since they have different business models etc to consider. The mechanism should also be capable of extension, if necessary, to cover additional demonstration projects, post 2016, and future retrofitting.

The UK needs to have a broad range of technologies supported (at differing development stages), and criteria should include encouragement for projects using indigenous UK coal reserves (for overall energy security reasons) and that have the potential to contribute significantly to the UK's low carbon industrial strategy.

Criteria should also value projects that have potential to spawn follow-on demonstration and deployment projects, for industrial and chemical plants as well as for power stations. The criteria should encourage projects that are future-proofed for such reasons, e.g. transport infrastructure that can cope with more CO₂ than will be produced by the first phase demonstration project alone (and at least as much as would be produced by the whole plant). The criteria should also give credit for projects that have effective knowledge sharing arrangements built in.

Public acceptance is a crucial issue for wide-scale CCS deployment, so projects should also seek to communicate with the public and build this acceptability. There is an important role for non-industry stakeholders here too, since sometimes the public views industry information with some scepticism.

Chapter 6: Maximising the benefits to the low carbon economy; a strategic role for Government

Question 6.1 What are your views on how the CCS demonstration projects could make the most cost-effective contribution to future carbon dioxide infrastructure?

Question 6.2 What are your views on how can we best ensure that CCS business clusters are encouraged, maximising the future opportunities for UK business?

The development of a strategic transport and storage network in the UK is likely to be helped if a serious effort is made to prove at least 3 or 4 storage sites by 2016. In time, it would probably make sense if these were linked.

Clustering is generally supported, but care must be taken to ensure future climate scenarios and resource availability (e.g. of cooling water) are considered. There is a role for IPCC here. Given the speed of demonstration and deployment required, it will also be necessary to evaluate trade-offs between potentially increased deployment speed by focussing on relatively well-advanced projects that are not necessarily clustered and waiting for a cluster of projects to be developed. It should also be noted that although it can be expected that clusters will decrease short-term demonstration costs, further work is required to explore whether they would necessarily reduce longer term costs that take into account later full-scale CCS

deployment. Where more than one project goes ahead in a particular region, it is likely that commercial arrangements would develop between them to optimize infrastructure.

Piping infrastructure costs are very dependent on whether CO₂ is in gaseous or super-critical state. CO₂ is transported safely in super-critical state in the US, so HSE should approve such transport in UK (in the appropriate circumstances) as a matter of priority, recognising that some of the concerns here are about safe distances from pipes and how frequently cut-off valves should be added, so there are good reasons for HSE to examine these issues for the UK context since the UK is generally more densely populated than areas that typically have CO₂ pipes in the US.

Infrastructure development should also consider the differing levels of public acceptability in different locations, e.g. depending on existing and past industrial activity in the area. Business clusters will be attracted to regions with transport and storage infrastructure, which Government should support.

Business opportunities need to be factored in and exploited from the outset – UK industrial strategy must not make the mistakes of the past (e.g. wind energy and Flue Gas Desulphurisation) and let ideas developed in the UK be exploited and commercialised elsewhere. These opportunities are not limited to the major players, but extend to thousands of small businesses who have innovative technology essential to improving capex and opex of capture plant.

Development of storage infrastructure should not necessarily be left to a few existing major incumbent oil and gas companies either – a fast and reasonable licensing regime is needed that allows innovative new entrants into the market.

Question 6.3 Are there any other actions that the Government should consider taking at this stage to prepare for the full commercial deployment of CCS?

CCS needs to have its place in the wider low carbon energy context. This will need preferential treatment for all forms of low carbon energy and premiums for such energy being high enough to spawn investment and innovation.

Other issues relevant to the full commercial deployment of CCS include the development of appropriate transport and storage regulations (e.g. licensing) and international agreements regarding the shipping of CO₂.

Gas should not be ignored; for example, requiring all new gas powered plants to be able to run on hydrogen (and, to a lesser extent, syngas) as well as natural gas would increase the options available for coal/CCS retrofitting.

Acknowledgments

On behalf of the Energy Institute, this submission was prepared by Brian Robinson CEnv CEng MIMechE DipEM with contributions from EI members with specialist knowledge on Carbon Capture and Storage. It was peer-reviewed by Prof Mike Farley FEI, Director of Technology Policy Liaison, Doosan Babcock Energy, Judith Shapiro, Policy Officer, Carbon Capture and Storage Association, Nicholas Perry MEI, Consultant, Perry Energy Services and Hannah Chalmers GradEI, Imperial College.

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