

# **A framework for the development of clean coal**

## **Consultation response**

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## Summary

### Overview

'A framework for the development of clean coal' was published for public consultation in June 2009. This document sets out how the Government now intends to bring forward an ambitious policy framework to enable the transition to clean coal as part the UK's move to a decarbonised electricity system. In developing our policy, we have considered the advice from the Committee on Climate Change in their first annual report<sup>1</sup>, published on 12 October 2009, as well as the responses to the consultation and the Strategic Environmental Assessment. We are grateful to all those who shared their views with us.

### Context

Coal plays a vital role today in providing electricity supplies in the UK and globally – a role that is set to grow substantially in a global context and that we want to be able to maintain in the UK as part of a diverse and secure low carbon energy mix. But coal can only continue to contribute to our energy security if we can find ways to substantially reduce its carbon emissions. That is why the development and deployment of carbon capture and storage (CCS) is so critical. Our new policy framework for clean coal is designed to contribute to the pathway towards the decarbonisation of the power sector and our 2050 climate change goals. In summary, our policy framework comprises a programme of up to four CCS demonstration projects, representing a substantial contribution to the global efforts to develop CCS technology, which will lay the ground for a long term framework for the transition to clean coal.

### Key elements of our framework for clean coal

- **No new coal without CCS.** A programme of up to four commercial-scale CCS demonstrations, funded by a new CCS incentive, and a requirement for any new coal power station to demonstrate the full CCS chain (capture, transport and storage) at commercial scale.
- **A long term transition to clean coal.** Our ambition is to see CCS ready for wider deployment from 2020 and for any new coal plant constructed from then to be fully CCS from day one. We expect demonstration plant will retrofit CCS to their full capacity by 2025, with the CCS incentive able to provide financial support. A rolling review process, which is planned to report by 2018, will consider the appropriate regulatory and financial framework to further drive the move to clean coal. In the event that CCS is not on track to become technically or economically viable, an appropriate regulatory approach for managing emissions from coal power stations will be needed.

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<sup>1</sup> Meeting Carbon Budgets - the need for a step change. Committee on Climate Change 2009.

## Part 1: A framework for the development of clean coal

### Clean coal at home and abroad

#### Worldwide need for CCS

- 1.1 We urgently need to find ways to reduce carbon emissions from fossil fuels if we are to avert dangerous climate change while enabling countries to maintain their energy security and industrial activity. Without decisive and collective action now, energy-related carbon emissions could more than double by the middle of this century.
- 1.2 The transition to low carbon electricity generation is an essential part of the move to a low carbon world. Clean energy technologies will have a crucial role to play, presenting opportunities for new businesses in a fast growing global sector, ensuring greater security of future energy supplies and adding to long-term economic growth.
- 1.3 Tackling emissions from coal is a priority: it is the fuel with the highest carbon emissions. It is also a reliable fuel for power generation, low cost, with abundant remaining global reserves and countries across the globe set to use increasing quantities for electricity generation<sup>2</sup>. Developed countries need to show leadership in demonstrating that we can decarbonise electricity generation from coal. If we cannot tackle emissions from coal, it is difficult to see how a move to a future global low carbon economy can be reconciled with the need for energy security and affordability. Tackling emissions from coal first makes sense both economically and for the climate.
- 1.4 Carbon capture and storage (CCS) has the potential to reduce carbon dioxide emissions from power stations by around 90 per cent, enabling fossil fuels to continue to be an important element of secure and diverse low carbon energy. Since we know that without CCS the cost of tackling climate change could be up to 70% greater<sup>3</sup>, now is the time to invest in CCS demonstration and develop our industrial and institutional capacity worldwide.
- 1.5 Our ambition is for CCS to be ready for widespread deployment from 2020. Achieving this will be very challenging, but we are determined to play our part – we need to work together as governments, industry and society to accelerate rapidly the commercialisation of this technology. The International Energy Agency estimates that we will need 100 CCS projects globally by 2020, not only on coal power stations, but also on gas power stations and industrial installations<sup>4</sup>.

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<sup>2</sup> Based on projected global demand, the IEA predict that the amount of electricity generated from coal could increase by around 23% in the US, around 172% in China and around 258% in India between 2006 and 2030. World Energy Outlook 2008.

<sup>3</sup> Carbon dioxide capture and storage: a key carbon abatement option. IEA 2008.

<sup>4</sup> Technology Roadmap: Carbon Capture and Storage. IEA 2009.

- 1.6 The Copenhagen summit at the end of this year gives us the chance to build on the growing international momentum for action – both the Carbon Sequestration Leadership Forum and the Major Economies Forum held in London in October marked out CCS as a key technology that must be quickly developed. Our goal for Copenhagen must be for the developed and emerging economies to work together to agree an ambitious deal that includes financial mechanisms and incentives that will accelerate the deployment of CCS so that it can play its part in the global fight against climate change.

## UK leadership at home and abroad

- 1.7 It is vital that the UK continues to be a global leader in promoting the development of CCS if we are to help it become a key component of action on climate change across the world. By acting early, we open up opportunities for UK businesses in a major future market expected to be up to £40bn by 2030, sustaining 30,000-60,000 jobs<sup>5</sup>.
- 1.8 In November 2007 the UK Government launched a competition to build one of world's first commercial-scale CCS demonstration projects. Following the confirmation in Budget 2009 of our commitment to proceed with the competition to contract award (subject to receiving suitable bids and being able to reach appropriate terms and, as with any long-term procurement, to final funding approval at the next Spending Review), we have already moved to the next stage of the process. We are now evaluating bids for detailed design and development studies and the successful bidder(s) will be announced early next year.
- 1.9 The UK continues to champion CCS through active engagement abroad through EU and global fora. Now, the Government's new policy framework on clean coal aims to accelerate the development and eventual wide-scale deployment of CCS technology and to stimulate further action across the world, as well as bring direct benefits to the UK.
- 1.10 Decarbonisation of the UK power sector will be central to our ability to reduce emissions in line with the pathway to our 2050 emissions goals. CCS will be one part of the solution and could enable coal to continue to play an important role in our energy security: coal currently meets 32% of UK electricity demand<sup>6</sup>, providing low cost, reliable and flexible electricity supplies. We also need to take action to enable the rapid deployment of other low carbon electricity supplies, namely renewables and nuclear. The draft National Policy Statements published for consultation alongside this document form part of a new planning framework that will facilitate delivery across all energy infrastructure.

## Driving the transition to a low carbon UK

- 1.11 The UK Government has put in place the world's first ever legally binding framework to tackle climate change, including a target to cut emissions by 80% by 2050 and a set of five

<sup>5</sup> AEA Future value of coal carbon abatement technologies to UK industry 2009.

[http://www.decc.gov.uk/en/content/cms/what\\_we\\_do/uk\\_supply/energy\\_mix/ccs/ccs.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/ccs/ccs.aspx)

<sup>6</sup> Energy Trends (2009 Quarterly) Department for Business Innovation and Skills / Department of Energy and Climate Change 2009.

year carbon budgets to chart the course and keep the UK on track. The ‘UK Low Carbon Transition Plan: National strategy for climate and energy’<sup>7</sup> published in July this year sets out how the first three of these budgets to 2022 are going to be met through the transformation of our power sector, dramatic improvements on energy efficiency, and switching energy demand in heat and transport to renewables and cleaner fuels.

- 1.12 Over half of the emissions savings needed to meet our first three carbon budgets will come from power and heavy industry and, as we continue on the pathway to meeting our 2050 goals, our electricity sector will need to be almost completely decarbonised. A key tool for delivering this transition to low carbon is the EU Emissions Trading System (EU ETS), which places a declining cap on emissions and creates a carbon price, making high carbon power stations less and less attractive – but this alone will not be enough to enable the rapid development of low carbon technologies. This is because other barriers exist to the early development and deployment of innovative energy technologies such as CCS, including high development costs combined with uncertainty over future cost and revenue streams (including the carbon price), which mean that risks to investors are high. Government intervention is therefore necessary to overcome the barriers to the development and deployment of low carbon technologies.
- 1.13 The challenge is to deliver the transition to a low carbon economy while maintaining security of our electricity supplies. We want to keep the benefits of using coal to generate electricity as it plays a valuable role in ensuring reliable energy supplies: coal power stations can respond to changing supply and demand (e.g. as back-up for intermittent renewables like wind or where there are unexpected problems with other power stations) – and provide diversity in the energy mix, in particular providing an alternative to gas. CCS would enable coal power stations to continue to play this role as we move to a low carbon energy mix. We are going to lose a third of our generation capacity in the coming decade, including many of our existing coal power stations, and further closures of existing coal power stations are expected in the early 2020s. So, we need substantial new generation capacity and we need the actions that we take today to ensure that this new investment moves us towards a low carbon mix.
- 1.14 We are currently working with industry and stakeholders on development of a 2050 roadmap setting out possible pathways to a low carbon UK, which will be published in Spring 2010. The 2050 roadmap will build on the Committee on Climate Change’s recent advice and identify pathways that allow us to meet our goals on emissions and energy security, including looking at the role that CCS could play in electricity generation out to 2050, under different scenarios. As we develop this work we will in particular take account of the Committee’s advice on emissions reductions through to 2030. In line with the Committee’s view that there will be a very limited role for conventional coal beyond the early 2020s, our clear expectation is that, with or without CCS, coal power stations will need to substantially reduce their emissions if they are to continue operating in the 2020s.

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<sup>7</sup> UK Low Carbon Transition Plan: National strategy for climate and energy. DECC 2009.

## Low carbon industrial strategy: maximising opportunities for the UK

- 1.15 The transition to a low carbon economy gives us the chance to build new industries of the future that will create jobs in the UK. In demonstrating CCS technology, we will sustain jobs in all the sectors that contribute to its development, which will give us the experience and knowledge to win contracts abroad. The demonstration projects could also stimulate business cluster development and form the basis for future regional carbon dioxide transport networks, both of which will enhance competitive advantage. As business activity focussed on CCS increases in a particular location, the build up of expertise and experience will draw in other entrepreneurs and innovators expanding the range of CCS related products and services. Also, the establishment of a nucleus for regional carbon dioxide transport will attract and retain energy intensive manufacturers that anticipate the need to use CCS in the future as emission limits are tightened.
- 1.16 UK businesses from a range of disciplines are well placed to exploit these opportunities when the market develops offering skills and expertise worldwide. As a result, the UK could win a significant share of the potential global market for CCS equipment and services, which could exceed \$5000bn in the next 40 years<sup>8</sup>. And the opportunities we create for the UK economy – through driving CCS at home – will also enable us to continue as a world leader in CCS and help global momentum.
- 1.17 In the UK our interventions are not only aimed at accelerating the development of the technology but at developing the capacity and skills base, promoting further innovation and infrastructure (physical and regulatory), potentially opening up a market to UK firms expected to be up to £40bn by 2030, so that we are reaping the benefits of moving first.

## A framework for the transition to clean coal

- 1.18 In developing our framework for the transition to clean coal, we have considered the advice from the Committee on Climate Change in their first annual report<sup>9</sup>, published on 12 October 2009, as well as the responses to our consultation (which are summarised in Part 2 of this document). In addition, environmental considerations relevant to the decisions we have made are set out in a separate Post Adoption Statement for the Strategic Environmental Assessment<sup>10</sup>, which builds on the earlier Environmental Report<sup>11</sup> and includes further detail on opinions expressed in the SEA consultation.
- 1.19 Our objectives are to:
- **Advance the global development of CCS technology.** We want to accelerate the development of CCS technology and stimulate further action across the world. Our ambition is to see CCS ready for wider deployment from 2020.

<sup>8</sup> Technology Roadmap: Carbon Capture and Storage. IEA 2009.

<sup>9</sup> Committee on Climate Change: Meeting Carbon Budgets - the need for a step change. 2009.

<sup>10</sup> SEA for a Framework for the Development of Clean Coal: post adoption statement. DECC. November 2009.

<sup>11</sup> SEA for a Framework for the Development of Clean Coal: Environmental Report. DECC. June 2009

- **Improve the affordability of CCS investment.** Our approach aims to ensure that the demonstration projects deliver value for money and are affordable. By investing in CCS demonstration now, we expect to reduce significantly the costs of wider CCS take-up in the 2020s.
- **Deliver a diverse and secure low carbon energy mix in the UK.** Our efforts to drive the development of CCS aim to enable coal to continue to play its valuable role in our energy security as we make progress towards our target to reduce UK emissions by 80% by 2050.
- **Help create jobs and economic opportunities for UK-based businesses** in a new industrial sector. We aim to sow the seeds of a new CCS infrastructure and industry in the UK, developing capacity, expertise and robust supply chains.

1.20 Our focus remains on coal power stations, as our first priority, because: the emissions from coal generation are substantially higher than from gas; the projected increases in coal use globally creates a greater urgency to tackling emissions from coal; tackling coal first makes the most economic sense as the carbon intensity of emissions from coal are much greater than from gas; and new coal power stations with CCS would contribute to the diversity and security of UK energy supplies as we make the transition to a low carbon energy mix. As far as gas power stations are concerned, they too face a carbon price under the EU ETS and must be constructed carbon capture ready. We expect these installations will, in time, also look to fit CCS.

1.21 In summary, the policy framework comprises:

- **No new coal without CCS.** A programme of up to four commercial-scale CCS demonstrations, funded by a new CCS incentive, and a requirement for any new coal power station to demonstrate the full CCS chain (capture, transport and storage) at commercial scale.
- **A long term transition to clean coal.** Our ambition is to see CCS ready for wider deployment from 2020 and for any new coal plant constructed from then to be fully CCS from day one. We expect demonstration plant will retrofit CCS to their full capacity by 2025, with the CCS incentive able to provide financial support. A rolling review process, which is planned to report by 2018, will consider the appropriate regulatory and financial framework to further drive the move to clean coal. In the event that CCS is not on track to become technically or economically viable, an appropriate regulatory approach for managing emissions from coal power stations will be needed.

1.22 Details on how aspects of this policy framework will be implemented are set out here; the timetable for setting out further details, particularly on how the demonstration programme will be taken forward, is set out in the next steps section.



## No new coal without CCS

1.23 Any new coal power stations built today will have a potential lifespan of several decades and, if they are to continue operating as we move to a low carbon energy mix, will in due course need to fit CCS technology to all of their capacity. Any new coal power stations built today are expected to have fitted CCS to their full capacity by 2025. As a signal of our longer term expectations – and to incentivise effective and timely development of CCS through actions and risks shared by the industry and Government – we will require any new coal power station in England and Wales to incorporate a commercial scale CCS demonstration covering all three parts of the CCS chain (carbon dioxide capture, transport and storage) with immediate effect. This new policy will be supported by regulatory and financial measures.

### Financial measures to support CCS demonstration

1.24 To facilitate investment in new coal generating capacity, notwithstanding the requirement for all new coal power stations to demonstrate CCS, we plan to provide funding for a programme of up to four commercial-scale CCS demonstrations on coal power stations. This represents a substantial contribution to the global efforts to develop CCS technology and will be supported by the introduction of a new CCS incentive funded through a levy on electricity suppliers. Establishment of the new incentive will require primary legislation and we included proposals in the Draft Legislative Programme for an Energy Bill to establish the framework for this financial support mechanism in the Fifth Session of Parliament (2009 -10).

1.25 In November 2007 the UK Government launched a competition to build one of the world's first commercial-scale CCS demonstration projects. In Budget 2009 we confirmed our commitment to proceed with the competition to contract award (subject to receiving suitable bids and being able to reach appropriate terms and, as with any long-term procurement, to final funding approval at the next Spending Review). As part of this commitment, we announced that there was funding of up to £90m available to fund the next stage in the competition: the completion of detailed design and development studies (FEED studies). On 6 November 2009, we received two bids to proceed to this next stage of the competition. We have the option to fund up to two FEED studies and the successful bidder(s) will be announced early next year, when we have evaluated the bids.

1.26 The programme of up to four projects will seek to demonstrate both pre- and post-combustion capture technologies (which could include oxyfuel), with a maximum of two of the projects demonstrating post-combustion capture. Support will be open both to coal power stations serving the grid and those serving industrial installations.

1.27 Ofgem will take on the role of managing agent for delivery of the CCS incentive and, in September 2009, Ofgem undertook a major restructuring to create a new business unit, Ofgem E-Serve. This new unit will focus on delivering a number of the Government's energy and environmental programmes including the new CCS incentive.

- 1.28 The arrangements for the monitoring and making of payments to the operators of CCS demonstration projects by Ofgem will be set out under a new regulatory framework created specifically for this purpose. The detailed arrangements under which a CCS demonstration project receives funding will be set out in statutory schemes known as “CCS Assistance Schemes”.
- 1.29 The CCS Assistance Schemes will provide a vehicle for funding and monitoring CCS demonstration projects and will work in much the same way as a traditional contractual arrangement. This approach will allow the Government to select the CCS demonstration projects and work together with developers to set the terms under which they will receive financial support. Support payments will then be administered by Ofgem, drawing on its expertise as the electricity licensing authority. This approach provides a permanent and structured framework, which to a large extent will be familiar to utilities.
- 1.30 Estimates of the cost of supporting four CCS demonstration projects through the new CCS incentive are made in the accompanying Impact Assessment<sup>12</sup>, including the impact on electricity bills. There will be no immediate impact on electricity bills; by 2020 the average annual impact on domestic and industrial bills for a programme of four demonstrations is expected to be an increase of 2-3%. We hope that at least one, and possibly two, UK CCS demonstration projects will qualify for EU support, which would reduce the impact on bills.
- 1.31 In addition to providing funding for a programme of up to four commercial-scale demonstrations of the full CCS chain from capture to storage, funding will continue to be available for innovative projects on pilot scale or for components of the CCS chain through, for example, the Environmental Transformation Fund.

### **Regulatory measures to support CCS demonstration**

- 1.32 The requirement for new coal power stations in England and Wales to demonstrate CCS will be implemented through complementary amendments to the existing regulatory regime for construction and operation of coal power stations, namely: development consent and operational permitting.
- 1.33 Development consent for power stations is currently determined by the Secretary of State for DECC, under section 36 of the Electricity Act 1989, and will in due course be the responsibility of the Infrastructure Planning Commission under the Planning Act 2008. In order to gain development consent, applications for construction of new coal power stations will now have to include technically feasible plans to capture the carbon dioxide emitted from at least 300MW net (around 400MW gross) of the power station’s capacity and the accompanying environmental impact assessment will have to consider the environmental impacts of the capture unit. Coal power stations of less than 300MW net capacity will have to show that carbon dioxide will be captured from their full capacity. Where operators submit a section 36 application that involves upgrade of an existing coal power station to supercritical boiler technology, they too will have to meet the

<sup>12</sup> Impact Assessment of Carbon Capture and Storage – a framework for the development of clean coal. DECC November 2009.

demonstration requirements. While the speed at which CCS technology will develop is uncertain, based on the need for and global commitment to CCS, it is the Government's expectation that new conventional coal power stations consented under the policy framework described here will retrofit CCS to their full capacity by 2025.

- 1.34 Where consent is given, it will be conditional on the developer submitting, prior to commencement of construction, evidence of: a valid CO<sub>2</sub> storage permit; the necessary consents, licences and permits for construction of the full CCS chain; and an Environmental Permit from the Environment Agency that incorporates conditions around the operation of the CCS chain.
- 1.35 We have published, for consultation, draft guidance for those seeking consent under section 36 of the Electricity Act 1989 (which will, in due course, also be followed by the Infrastructure Planning Commission as set out in the draft Overarching National Policy Statement<sup>13</sup>) to construct and operate a coal power station in England and Wales under this new policy<sup>14</sup>.
- 1.36 In order to operate, all power stations in England and Wales must hold an Environmental Permit from the Environment Agency. The Environment Agency then has an ongoing role in monitoring compliance, with powers of enforcement where breaches occur or are considered likely. Their enforcement actions depend on the level of the environmental threat but can range from informal warnings, to a temporary prohibition on operation until an issue is resolved, through to full revocation of the permit. Through secondary legislation under the Pollution Prevention and Control Act 1999, we will give the Environment Agency explicit powers to monitor the performance of CCS demonstrations. The Environment Agency will require operators of CCS demonstrations to set out a schedule for meeting a carbon dioxide storage target (where a 300MW net capture unit would be expected to store 20 million tonnes of carbon dioxide over 10-15 years) against which they will monitor the operator. Where operators are unable to show that they are making reasonable efforts to operate the CCS chain and meet the storage target, the Environment Agency will have recourse to its usual enforcement powers.

## **A longer term transition to clean coal**

- 1.37 Our domestic and international efforts to drive CCS technology forward aim to show that coal with CCS can contribute globally to tackling climate change and to enable a diverse and secure low carbon energy mix in the UK where fossil fuels with CCS sit alongside renewables and nuclear.
- 1.38 We will maintain a rolling review of progress with CCS technologies, with demonstration projects in the UK, EU and globally providing a vital source of evidence on the performance of CCS across technical, economic, environmental, safety and any other

<sup>13</sup> Draft National Policy Statements were published for consultation on 9<sup>th</sup> November 2009 and are available from [www.decc.gov.uk](http://www.decc.gov.uk)

<sup>14</sup> Supplementary Guidance for Section 36 Electricity Act 1989 Consent Applicants for Coal Power Stations. DECC. Published for consultation 9 November 2009. Consultation closes 1 February 2010.

relevant matters. The EU is aiming to have a programme of up to 12 CCS demonstrations operational by 2015. Based on EU and global experience of the technology, within three years we expect there to be sufficient evidence available on the costs and performance of the capture, transport and storage elements of the CCS chain to provide the evidence base for the development of a long term policy framework for coal and CCS.

- 1.39 So, by 2018 the Government plans to publish a report that will consider the technical, economic, environmental and safety status of CCS technologies in the light of progress with the demonstration projects in the UK and globally, drawing on expert advice from the Environment Agency, the independent Committee on Climate Change and others, including business; and consider the case for new regulatory and financial measures to drive the move to clean coal within the context of wider progress on the move to a decarbonised electricity system.
- 1.40 As part of the review process, the question of retrofit to demonstration projects will be considered. Our CCS demonstration programme is the first step towards enabling clean coal to contribute to a diverse and secure low carbon energy mix. At this relatively early stage in the development of CCS technology, capturing carbon dioxide from at least 300MW net (around 400MW gross) of a coal power station's capacity is ambitious and a necessary first step to seeing wider application of CCS. While it is necessary to provide financial support for CCS at this relatively early stage in its development, we must also recognise the need to secure value for money and the diminishing returns for learning once the demonstrations pass a minimum commercial scale.
- 1.41 Modelling suggests that coal CCS demonstration projects will directly displace investment in new gas power stations with no impact on investment in new low carbon renewable and nuclear capacity<sup>15</sup>. This means, first, that by enabling some new coal build up to 2020 we will see some additional diversity in the energy mix. Some 8GW of existing coal will close by the end of 2015 and we could see a significant proportion of this replaced by 2020 through the CCS demonstration programme. Second, the carbon emissions of a demonstration programme of this scale<sup>16</sup> would be very similar to the alternative gas generation displaced. Moreover, the demonstration programme is a stepping stone to full CCS deployment, which has the potential to play an important role in reducing UK and global carbon emissions.
- 1.42 While the speed at which CCS technology will develop is uncertain, based on the need for and global commitment to CCS, it is the Government's expectation that new conventional coal power stations consented under the policy framework described here will retrofit CCS to their full capacity by 2025. This could be delivered through technical measures and/or a plant level emissions limit monitored by the Environment Agency. The new CCS incentive will be able to support retrofit to the demonstration projects, with any decisions on

<sup>15</sup> Carbon Capture and Storage demonstration: analysis of policies on coal/CCS and financial incentive schemes. Redpoint 2009.

<sup>16</sup> For example, a programme of two 450MW pre-combustion and two 400MW post-combustion demonstrations, on 450MW and 1.6GW of coal capacity respectively would give 4.1 GW of new coal capacity, of which 1.7 GW (40%) would be abated. If one of the post-combustion projects was on an existing plant, there would be 2.5GW of new capacity of which 1.3GW would be abated (52%).

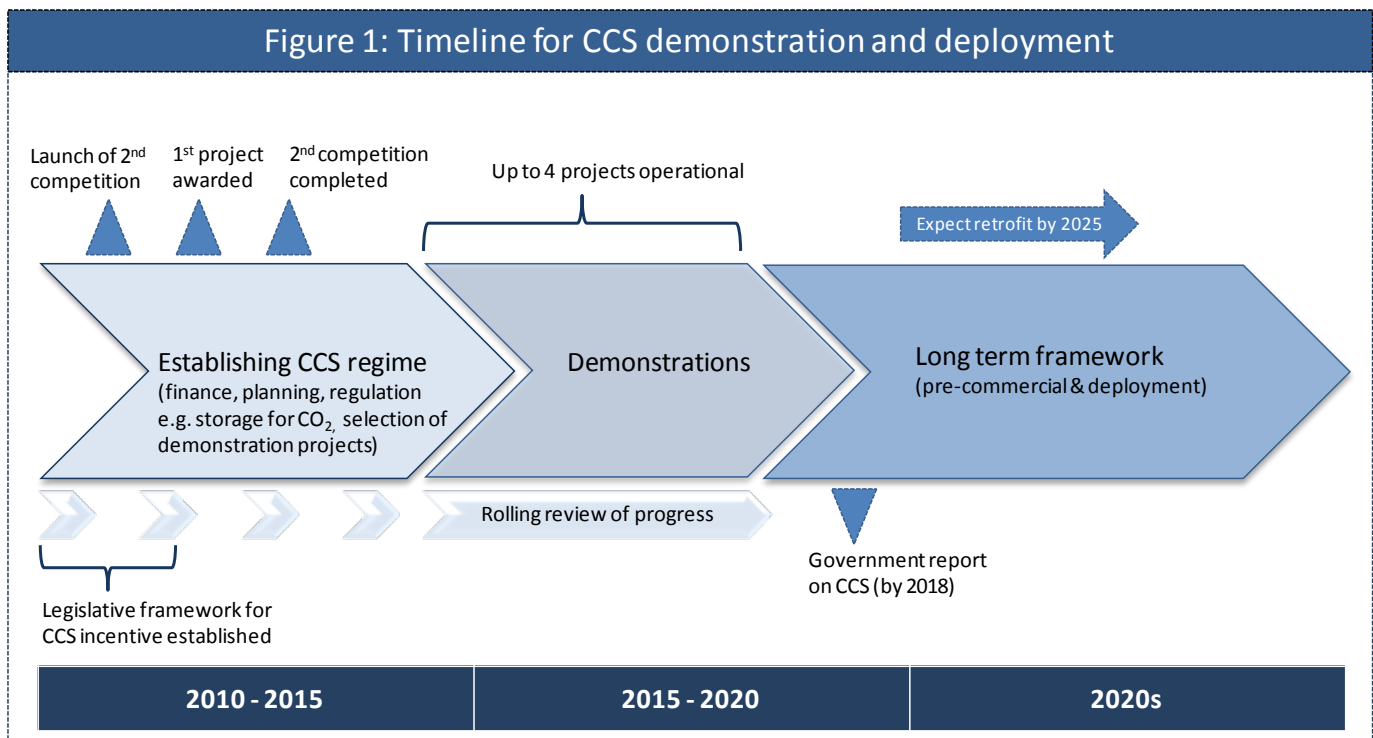
additional funding over and above the existing demonstration commitment considered as part of the review process, taking fully into account value for money considerations. We do not expect the question of retrofitting to be relevant for IGCC coal power stations where operators are expected use gas to fuel any part of the power station that is not fitted with CCS.

- 1.43 We must also look beyond the coal power stations that will contribute to our CCS demonstration programme and lay the ground for a long term framework for the transition to clean coal that is in line with pathways towards our 2050 climate change goals.
- 1.44 We are planning on the basis that CCS will be ready for wider deployment by 2020. So, the report will consider the framework within which new coal power stations would be constructed beyond the CCS demonstration phase. As we set out in the consultation document, our expectation is that new coal power stations will be fully CCS from day one once CCS has been shown to be economically and technically viable, and that this will be possible from 2020.
- 1.45 In the event that CCS is not on track to become technically or economically viable, preventing retrofit to demonstration projects, an appropriate regulatory approach for managing emissions will be needed. The review will consider what additional measures, consistent with and complementary to the EU ETS and any other market interventions that are in place, are necessary – such as an emissions performance standard by way of a plant level cap.
- 1.46 Environment Agency expertise will be an important contributor to the review, and we expect that they will draw on evidence that they will be collating to provide an evidence base for the BAT (Best Available Techniques) process: we want to see CCS identified as BAT as early as possible, although economic factors may mean that this is not possible by 2018, and in any case different CCS capture technologies may become BAT at different times. The Environment Agency’s ongoing contribution to the information exchanges that inform BAT assessments across Europe, through the BAT reference documents, will be essential.
- 1.47 All of this work will be developed in the light of continuing advice from the independent Committee on Climate Change and in a way that is consistent with the need for a clear UK emissions reduction pathway through to 2030 and beyond to 2050.
- 1.48 Building on the framework proposed in our consultation document, taking account of responses to the consultation and the recent report from the independent Committee on Climate Change, we have strengthened our framework in a number of significant ways:
- We remain committed to a programme of up to four CCS demonstration projects in the UK with no more than two post-combustion projects;
  - We have decided that existing coal power stations that upgrade to supercritical boiler technology should, like new coal power stations, be required to demonstrate CCS as they will have equivalent lifetime expectations;

- We have opened the CCS incentive to coal power stations dedicated to serving large industrial installations, as well as those serving the grid, which should add to the number and diversity of projects that come forward, maximising the prospects for achieving the demonstration programme’s objectives;
- We have extended the scope of the CCS incentive so that it can, if necessary, fund the retrofit of demonstration projects, giving greater certainty to investors.
- We have moved away from a concept of testing when CCS is technically and economically proven to a broader assessment of the status of CCS and its role in decarbonisation of the electricity mix, partly to reflect that a key factor in driving early CCS deployment is likely to be the availability of financial support. As part of this, we have committed to a rolling review process, informed by expert advice from the Environment Agency, the Committee on Climate Change and others, with a report by 2018.

## Next Steps

1.49 Over the coming months we will be taking forward a number of measures that will help deliver our framework for clean coal, continuing to be informed by the responses to the consultation, and the following sections give detail on a number of these. Figure 1 shows our longer term timeline for CCS demonstration and deployment.



## **Funding CCS demonstration**

- 1.50 Establishing a dedicated financial support mechanism for CCS will require new legislation, which is why we included proposals in the Draft Legislative Programme for an Energy Bill to establish the framework for this mechanism in the Fifth Session of Parliament (2009 - 10).
- 1.51 Over the coming months we will be working with stakeholders as we further develop these policies and we expect, subject to successful enactment of the Bill, to consult formally in early Summer 2010 on the detail of the secondary legislation required to fully implement the CCS incentive. Our aim is for the statutory framework for supporting CCS, including the necessary regulations, to be in force in time to support the first CCS demonstration project under the existing competition.
- 1.52 We have received two bids to proceed to the next stage of the competition for the first CCS demonstration competition. We have the option to fund up to two FEED studies, for which up to £90m is available, and the successful bidder(s) will be announced early next year, when we have evaluated the bids.
- 1.53 In parallel, we will continue to develop the CCS demonstration programme and, building on this consultation, we will be working with stakeholders as we finalise the objectives, criteria and process for selecting projects beyond the first competition.
- 1.54 We plan to launch a competition for the selection of further CCS demonstration projects towards the end of 2010 and to complete the process during 2011.
- 1.55 The UK is closely engaged with the development of the EU funding mechanism for CCS demonstration projects and we hope that at least one, and possibly two, UK CCS demonstration projects will qualify for EU support. We will develop guidance to potential project investors once it is clear how the UK and EU funding mechanisms will operate together.

## **Demonstration - ensuring compliance**

- 1.56 The consultation on draft guidance for those seeking development consent for a new coal power station under section 36 of the Electricity Act 1989 or, in due course, from the Infrastructure Planning Commission under the Planning Act 2008, closes on 1 February 2010. In line with normal practice, applications will continue to be processed during this consultation on the guidance, provided they comply with the new policy on CCS demonstration.
- 1.57 We will publish for consultation our proposals for draft secondary legislation under the Pollution Prevention and Control Act 1999, setting out the Environment Agency's new powers to set conditions relating to CCS, including how the Environment Agency will judge whether operators are making reasonable efforts, early in 2010.

## **Transport & Storage**

1.58 The UK has set up one of the first purpose designed legal regimes anywhere in the world to permit the storage of carbon dioxide. These arrangements apply to the offshore area only, and also clarify property ownership rights. We are now consulting on the detail of those arrangements and the implementation of the EU Directive on the Geological Storage of Carbon Dioxide. Deployment of CCS will require considerable investment in transport and storage infrastructure. We will be setting out arrangements that will facilitate this investment and its integration into a network over time. Developers of new infrastructure will be required to consider the opportunity for joint investments prior to seeking government approval for construction, and the Secretary of State will have fallback powers to require such modification. There will also be arrangements for facilitating expansion and efficient utilisation of existing infrastructure. These arrangements will be subject to ensuring the integrity of the system and the interests of the original investors.

## **Existing coal power stations**

1.59 We are currently working with industry and stakeholders to publish a 2050 roadmap setting out possible pathways to a low carbon UK through to 2050. Our whole policy framework for coal and CCS must be compatible with our 2050 goals and one issue that we will consider further as part of this work is whether any additional interventions to reduce emissions from the UK's existing coal power stations are likely to be needed.

## **Clustering and business opportunities**

1.60 There are significant business opportunities presented by CCS from our natural assets in the North Sea, both carbon dioxide storage capacity and some potential for enhanced oil recovery. It is important that UK business is able to maximise these benefits. We are considering how best to ensure that the demonstration programme contributes to this process. Our work on developing the objectives and criteria for selection of projects will take account of this, including the role that clusters might play, whether this involves co-location of more than one demonstration project or the development of related business capability cluster around a demonstration project.

1.61 The Government will publish a CCS Industrial Strategy that considers the wider issues arising from the potential role of clusters, and the development of business and research centres, skills, and transport and storage infrastructure.



## Part 2: Summary of Responses

### Background

- 2.1 The consultation “a framework for the development of clean coal” was launched on 17 June 2009 and closed on 9 September 2009. The document sought views on the design of a financial incentive to support the delivery of up to four Carbon Capture and Storage (CCS) demonstration projects in the UK and a regulatory framework for coal power stations that would drive the development and deployment of CCS technologies and reinforce our expectation that emissions from coal power stations will be substantially reduced in the 2020s.
- 2.2 In particular, the consultation covered the following areas:
- **Chapter 1** set out our vision for clean coal at home and abroad, and described four objectives for how our proposed framework should be judged: advancing the global development of CCS technology; improving the affordability of CCS investment; delivering a diverse and secure energy supply in the UK; and helping create jobs and economic opportunities for UK-based businesses in a new industrial sector.
  - **Chapter 2** set out the rationale for strategic government intervention to drive the development and deployment of CCS considering: the need to decarbonise electricity supplies; the contribution of coal to secure and affordable energy supplies within the UK and globally; and the potential role of CCS in reconciling these two objectives.
  - **Chapter 3** set out an overview of our proposed financial and regulatory framework for clean coal, discussed the objectives of the UK’s CCS demonstration programme, and considered how emissions performance standards could contribute to our framework.
  - **Chapter 4** considered each of the regulatory aspects of the proposed framework. Firstly, the proposal that any new coal power station should be required to demonstrate CCS on a defined proportion of its capacity; secondly, the proposal that those demonstration power stations should be required to retrofit CCS to their full capacity within some five years of the technology having been proven, and that any further new coal station should then be fully CCS from day one; and thirdly possible approaches to a contingency measure should CCS not be proven as early as we expect.
  - **Chapter 5** considered the financial aspects of the proposed framework, focusing on the design of the new mechanism that will provide funds to support CCS demonstrations; the possible approaches to payment of the incentive to CCS projects; and how the UK approach should mesh with the funding available from the EU.
  - **Chapter 6** explored how we can ensure that we maximise the benefits to the UK economy through our interventions, including how we could best lay the foundations of a future CCS infrastructure.
- 2.3 A total of 2348 responses to the consultation were received (see breakdown below). The majority of responses were from individuals which may have originated from appeals from the Royal Society for the Protection of Birds (RSPB) and the World Development Movement (WDM).

Groups	Number of respondents
<b>Individual responses</b> (majority appeared to originate from RSPB & WDM appeals to members)	2252
<b>Academic/Professional Institutions</b>	7
<b>Government</b>	17
<b>Industry - Business</b>	27
<b>Industry - Operators</b>	13
<b>Non Governmental Organisations (NGOs)</b>	11
<b>Trade Association/Trade Unions</b>	16
<b>Other</b>	5

Note: The term industry in this summary of responses refers to operators and businesses. "Operators" are defined as those companies who operate or hope to operate coal power stations in the UK, with "business" covering equipment manufacturers, oil and gas companies and any other companies.

- 2.4 A consultation email address ([coalandccsconsultation@decc.gsi.gov.uk](mailto:coalandccsconsultation@decc.gsi.gov.uk)) was set up, to which all stakeholders and members of the public were invited to submit their comments. The consultation document was made available online and sent out in hard copy on request. A list of those invited to respond was at Annex 2 of the consultation document, while **Annex A** here lists those bodies who responded, or with whom meetings were held. We are grateful for the time and thought put into these responses by all concerned.
- 2.5 This chapter summarises the responses to the consultation; full versions of responses from organisations can be found on the DECC website ([www.decc.gov.uk](http://www.decc.gov.uk)).

## Detailed Analysis

### Overview

#### Consultation 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? Please provide evidence to support your views.**

- 2.6 Many responses welcomed the consultation document as a clear commitment from Government to the development of Carbon Capture and Storage (CCS) technologies. Respondents were broadly supportive of the framework's objectives of advancing global development of CCS technology, improving the affordability of investment, delivering a diverse and secure low carbon energy supply and helping to create jobs and economic opportunities in the UK. However, there was a general view that the framework of financial and regulatory measures for the development of clean coal as proposed would need to be developed further to enable delivery of those objectives.
- 2.7 Many industry respondents argued that we need a greater level of ambition on CCS to send a clear signal to investors, otherwise it was likely that the proposed framework would not deliver wide-scale clean coal power stations at home or abroad. In particular industry respondents put forward a view that the open-ended nature of the proposed approach to a requirement to retrofit and contingency policy presented significant risks to investors. To help alleviate this, it was argued that a clear roadmap was required by investors detailing timescales to wide-scale CCS deployment. Many non-Government Organisations (NGOs) argued for delivery of higher levels of ambition in the trajectory to a decarbonised electricity system.
- 2.8 Many argued that the framework should extend to gas as well as coal. For some, this was about equalising the regulatory burden on coal and gas power generation, for others it was about setting the pathway for decarbonisation of the whole electricity sector.

#### **Finance: funding CCS demonstrations**

- 2.9 On funding for the CCS demonstrations, the need to accelerate the delivery of the demonstration projects, with at least four projects confirmed as soon as possible, was a point that was widely made. There was also general agreement that a call for all CCS demonstration projects (additional to the existing competition) should be made at the same time. On funding, there was broad support to use a contract for difference disbursement mechanism and some industry respondents mentioned the need for capital payments during construction of the CCS chain.

#### **Regulation: requiring CCS demonstration**

- 2.10 Many respondents supported the proposal that new coal plant should be required to demonstrate CCS, although this was often contingent on there being sufficient funding available for CCS demonstration. Some considered it unnecessary to require demonstration given that all coal plant must already be constructed Carbon Capture Ready (CCR). The proposed amendments to planning were broadly supported, although

some industry respondents suggested that the most efficient approach would be to award consent on the basis of conditions to be met before operation started. The proposals for monitoring and enforcement were generally supported, with the Environment Agency (EA) being regarded as an appropriate body to take this implementation role.

### **Regulation: requiring CCS retrofit**

- 2.11 There was a variety of views on the requirement to retrofit. Some supported the proposal; others considered it unnecessary with the EU Emissions Trading System (EU ETS) in place and/or that it was inappropriate to signal retrofit while CCS is still at the demonstration stage. Many developers were concerned about the potential impact on their investments and said that the proposal as framed would block investment. Some argued that Government should commit now to funding retrofit, while others wanted to see a strengthened commitment to market based mechanisms such as the EU ETS instead. Most agreed that the EA would be a suitable body to assess when CCS is *technically* proven and implement any requirement to demonstrate. There was no consensus on who should assess when CCS is *economically* proven.

### **Regulation: Contingency**

- 2.12 There was a wide range of views on the need for a contingency measure. Industry tended to believe a contingency was likely to discourage investment in new coal power stations and CCS development, and variously suggested that it would undermine the EU ETS and suggest a lack of confidence in CCS. Most NGOs and individuals argued that that a contingency, by way of an Emissions Performance Standard, was necessary.
- 2.13 Other points made by respondents on the proposed framework included:
- The framework should prioritise value for public money and ensure cost impacts on electricity users are kept to a minimum.
  - The contribution of the policy framework to sustaining manufacturing industries should be considered alongside other objectives.
  - Further thought should be given on wider regulation and funding for transport and storage infrastructure, especially with regard to establishing clusters: major investment is required in relation to these.
  - The UK has an opportunity to be a world leader in CCS with a significant storage resource in the North Sea.
  - CCS will play an essential role in the generation mix of the future and will help to deliver UK and EU climate change targets.
  - The UK should develop its economically viable coal reserves.
  - The UK should focus on CCS technology solutions which are at a more advanced state of development.

Consultation Question	
3.2	<b>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? Please provide evidence to support your views.</b>

2.14 Many respondents, particularly from industry, were concerned that the proposals in the consultation would deter investment in new coal and CCS demonstrations in the UK. They said that the framework as outlined gave investors insufficient certainty on the impact of future regulation, particularly around the retrofit and contingency proposals, and would subsequently leave a significant risk for companies considering construction of CCS demonstration plants. Investors might therefore decide to invest in coal and CCS in other countries where the regulatory regime was more suitable, rather than the UK, or might look to invest in gas facilities instead of coal, with implications for security of supply. This led some to argue that the proposals should be extended to gas. Some industry responses also said the proposals would not encourage investment in the full range of technologies needed at demonstration stage: they saw the proposals as favouring pre-combustion capture technology as Integrated Coal Gasification Combined Cycle (IGCC) plants can be built on a smaller scale.

2.15 To encourage investment in coal and CCS in the UK, respondents suggested various actions which included:

- Providing a clear vision or roadmap for CCS (including for transport and infrastructure) with timescales and support mechanisms that go beyond the demonstration phase and are in line with climate change targets.
- Clarity on the requirement to retrofit including financial support for retrofit.
- Clarity on the plans for a contingency.
- Committing to four demonstration projects.
- Contributing up front to the capital cost of constructing CCS demonstration coal plants.
- Encouraging developers to invest in the most competitive projects to accelerate commercialisation.
- Beginning a public awareness campaign for CCS, particularly in the storage aspects of the CCS chain.
- Ensuring that the necessary skills and competencies are available to develop and support CCS.

2.16 According to some NGOs, the impact of the proposals on decisions to invest in CCS was secondary to the issue of whether the framework would rule out new emissions from coal: it was important to prevent and discourage investment in conventional coal. NGOs thought that the introduction of an Emissions Performance Standard, combined with the finance for the demonstrations, would encourage investment in CCS without jeopardising

climate change goals. One NGO also suggested that some form of under-writing of potential liabilities would give confidence in the future deployment of CCS.

### Consultation Question

**3.3 What are your views on the proposed objectives of the UK CCS demonstration programme, including the scale of individual demonstration projects? Please provide evidence to support your views.**

- 2.17 The consultation document suggested a number of objectives for the CCS demonstration programme, which would form the basis for the criteria for selecting projects. A number of respondents provided comments on each of the objectives (listed below) and some suggested additional objectives. Some commented that achieving these objectives would only be possible if there were four demonstration projects on a timescale which leads or matches activity elsewhere.
- 2.18 There was a range of opinions on the scale of individual projects with some respondents agreeing with the suggested size of demonstration projects in the consultation – around 450-500MW on pre-combustion and at least 300MW net post combustion, storing 20 million tonnes of carbon dioxide over 10-15 years. Some felt that an effective next step in demonstration for oxyfuel projects would be around 100-150MW. Other respondents felt that the suggested sizes were too prescriptive and projects should be encouraged to develop larger or smaller projects where appropriate, whereas many NGO and individual respondents believed all demonstrations should be 100% CCS from the start.
- 2.19 Arguments for allowing smaller demonstration projects included the need for a scaled approach so technology and commercial risks could be reduced and managed, and the fact that projects would be cheaper for the electricity consumer. An industry respondent suggested that a target of 10 million tonnes of carbon dioxide stored over 10 years is a more appropriate target for demonstration phase. Arguments for larger demonstrations included the need for greater ambition and achieving better value for money through economies of scale and the removal of future regulatory risk.

#### **Specific comments on the objectives:**

##### **To gain experience of a range of CCS technologies.**

- 2.20 In general, respondents supported this objective, highlighting that the demonstration programme should cover a range of capture, transport and storage options. Opinions varied from the need to cover all available capture technologies (post-combustion, pre-combustion and oxyfuel) to suggestions that oxyfuel is not yet ready to be demonstrated at commercial-scale. Those who disagreed with this objective felt that the range of technologies should be demonstrated on an EU, as opposed to a UK level, and support should go to the technologies closest to being proven within the UK.

**To develop a broad and sustained UK capability in the design, construction and operation of alternative CCS technologies that will be capable of capturing a significant share of the expected global market.**

- 2.21 Respondents commented that developing at least four demonstrations across a range of technologies will help maximise UK capability and the ability to transfer the technology to developing nations. Other comments included support for a continued programme of R&D, skills training and promotion of UK CCS jobs where possible.

**To maintain momentum in the UK development of CCS that will be sustained until the technology is expected to become commercially viable.**

- 2.22 Some respondents commented that a more ambitious timetable is needed to achieve this objective, as well as a sustained R&D programme and rapid delivery of the maximum number of demonstration projects possible. A few respondents also commented on the need for steady growth across the demonstration programme rather than an approach that would see long time gaps between CCS projects. This would ensure a more sustained growth in CCS business development.

**To establish CCS as “best available techniques” (BAT) for the deployment of clean coal power generation in the UK, which will require the establishment of a strong knowledge base on the cost and performance of CCS technologies.**

- 2.23 There were few comments on this objective. One respondent expressed concern that BAT will not be reached if the demonstration programme focused on too many combinations of technology. Respondents also commented on the need to consider other uses of CCS e.g. on gas and underground coal gasification. BAT is discussed further in the response to Question 4.7.

**To help establish competitive supply chains for CCS design, equipment and operation.**

- 2.24 Respondents commented on the importance of this objective in ensuring the UK develops a supply chain in CCS design, equipment and operation and has the appropriate skills base to support it. There was support for having at least four demonstration projects to maximise this advantage and so maintain momentum and build up industry skills and resources to enable eventual deployment.

**To accelerate diffusion of knowledge on CCS both within the UK and globally.**

- 2.25 Some responses commented on the need to determine a mechanism for sharing knowledge between the UK, EU and rest of the world, as well as establishing as early as possible ownership of Intellectual Property generated by the demonstration projects and consideration of how information will be used to help progress CCS in the UK and abroad.

**To deliver projects that are affordable and represent value for money.**

- 2.26 In general, respondents supported this objective with some suggestions that projects should not be selected on size but instead on value for money of carbon saved (on the basis that larger projects represent best value for money for consumers e.g. Powerfuel's response states that a 450MW IGCC/CCS project would cost 75-80% of the cost of a

900MW plant). There were also comments that value for money of CCS should be considered in relation to other low carbon technologies, such as offshore wind, allowing the market to determine the most appropriate low carbon technologies for investment/support.

2.27 Other suggested objectives included:

- Contribution to reducing carbon dioxide emissions in the UK.
- Demonstrating climate change leadership to the rest of the world.
- To build investor confidence through a stable regulatory regime.
- To build public confidence/awareness of CCS.
- To develop transport and storage infrastructure for future CCS deployment.
- To demonstrate the benefits of clusters.
- To rapidly develop the framework and capability to move from demonstration to deployment of CCS in the early 2020's.

#### Consultation Question

**3.4 What are your views on whether and how an emissions performance standard (EPS) could support our policy objectives? Please provide evidence to support your views.**

2.28 There was a wide range of views on whether and how an emissions performance standard (EPS) could support our policy objectives. These fell into three broad areas, one view being that it was premature to introduce an EPS until CCS has been demonstrated, another being that we should leave the EU ETS as the primary emissions reduction tool and another that we should use an EPS to provide regulatory certainty and drive investment in CCS.

2.29 Some industry respondents expressed a view that setting EPS policy would be premature at this stage of CCS technology development; decisions around the introduction and design of any EPS should take place once the CCS demonstration projects have been evaluated. The main aim at this stage should be to set out a long-term framework of CCS regulation, rather than state specific details.

2.30 Some responses, particularly from industry, believed that the EU ETS should remain the primary emissions reduction tool for the electricity generation sector. This was because the EU ETS is designed to provide assurance that carbon dioxide emissions from the sectors covered are consistent with the requirement to reduce global emissions while leaving the market to identify the most economic options to reduce emissions. Some industry stakeholders, including most operators, thought an EPS would therefore risk undermining the EU ETS, for example by reducing political commitment across Europe to ensuring the EU ETS delivers a robust carbon price, and denying generators the



opportunity to mitigate carbon risk through investment in a diverse plant portfolio of low carbon technologies.

- 2.31 Respondents who expressed the above views tended to also think that additional regulation such as an EPS would deter investment in the CCS demonstration programme and/or lead to unabated gas being built. Proposed solutions included introducing an EPS which does not discriminate between coal and other fossil fuels (and other industries) and only applying an EPS alongside financial incentives.
- 2.32 The other view given by respondents argued that an EPS would have real value in providing a market signal for CCS and other options for reducing emissions such as Combined Heat and Power and other efficiency improvements. This group, including many NGOs and individuals, believed it would be unwise to rely on the EU ETS to limit carbon dioxide emissions from coal plants. They argued that an EPS would provide greater regulatory certainty and so help drive investment and provide greater confidence that timely emission reductions will be delivered.
- 2.33 Some respondents suggested the level at which an EPS should be set, notably the NGOs, who developed a joint position<sup>17</sup> suggesting an EPS should be set at 300g carbon dioxide/kWh now, then scaling down to 100g carbon dioxide/kWh in 2025 to ensure the decarbonisation of the electricity system. Other respondents thought further work was needed before defining the level of an EPS.
- 2.34 Other points raised included:
- If an EPS was implemented, something more flexible than a carbon dioxide/kWh measure would be needed such as an annual emissions limit relative to a plant's capacity.
  - An EPS could be important for setting standards for CCS projects and for regulating them.
  - If there must be an EPS it should be specified now so it could be factored into investment appraisals.
  - The cost of meeting an EPS would be passed to consumers.
  - Imposing an EPS on coal power stations was inconsistent with the currently recognised Best Available Technique (BAT) approach for setting abatement performance standards because CCS was not yet proven or available.
  - The introduction of a UK EPS might require changes to EU legislation.

<sup>17</sup> A joint statement was made by Christian Aid, Friends of the Earth, Greenpeace, RSPB, Oxfam, World Development Movement and WWF

## The proposed regulatory framework

## Requiring demonstration

## Consultation Question

<b>4.1</b>	<b>Do you agree, in principle, that new coal power stations should be required to demonstrate CCS? Please provide evidence to support your views.</b>
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2.35 There was broad agreement that new coal power stations should be required to demonstrate CCS, but with a number of caveats to this.

2.36 Some NGOs did not want to see support for the demonstration of CCS used as a means of justifying the consent of new largely unabated coal fired power stations. They believed that any new coal plant should be fully abated. Some respondents, particularly NGOs, thought post-combustion CCS demonstration should be tested on existing plant as this would mean the demonstrations would be operational much earlier, would not add to emissions, and learning would be applicable to both sub-critical and super-critical plants. Some NGO respondents were content for new plant to be built for demonstrating pre-combustion CCS because these plants would contribute less to UK emissions and be capable of capturing all emissions from each boiler where CCS is applied. The other view expressed mainly by NGO respondents was that any new coal plants should be required to meet a boiler based Emissions Performance Standard (EPS).

2.37 The agreement with the proposed requirement to demonstrate by many industry respondents was often contingent on there being adequate funding available for the CCS demonstration programme. As part of the funding for CCS demonstration, some industry respondents thought capital expenditure should be paid up front, and that costs involved with retrofitting CCS should be underwritten, otherwise investment in new coal plants might be deterred. Some industry respondents also suggested that the requirement to demonstrate should be extended to cover all new fossil fuel plants to enable greater progress towards the decarbonisation of the electricity sector by 2030.

## Consultation Question

<b>4.2</b>	<b>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? Please provide evidence to support your views.</b>
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2.38 The general view from respondents was that in order to meet a requirement to demonstrate, operators should have to gain Section 36 planning consent of the Electricity Act 1989 as usual, with the provision that the plant cannot operate without gaining other consents needed to operate the CCS chain. These other consents would be for the demonstration capture plant and for the pipeline and storage. Some industry respondents thought that gaining Section 36 consent first would enable the operator to proceed through the process with some confidence that the project was likely to happen. This

knowledge would be helpful in obtaining engineering studies and associated consents such as environmental permits and should mean the overall process is quicker than trying to obtain all permits before applying for consent.

- 2.39 Alternative approaches suggested by a few operators included granting development consent conditional on the demonstration plant being commissioned and becoming operational at the same time as the generating station or a two stage process that gives high level approval for transport and storage initially, with the detail coming later.
- 2.40 Some respondents argued that the current planning guidelines were adequate to meet the requirement to demonstrate, in that they already specified a power station had to be Carbon Capture Ready (CCR). A number of responses made reference to the point that all fossil fuel power plants should be subject to the same planning conditions as those proposed for coal power stations.
- 2.41 Some NGO responses were concerned to emphasise the need for applications which would minimise environmental and safety risks and maximise cost effectiveness of future network development.
- 2.42 Other points made by respondents to this question included:
- The need to consider further the criteria for obtaining storage licences and to consider a national planning statement on carbon dioxide transport and storage infrastructure to help speed this part of the planning process up.
  - Planning conditions should refer to the need to retrofit once proven.
  - Delays to gaining development consent impact on negotiating supplier contracts and costs.

#### Consultation Question

**4.3 What are your views on the best approach to monitoring the operation of CCS demonstrations? Please provide evidence to support your views.**

- 2.43 Responses to this question generally stated that appropriate monitoring and enforcement regimes were already in place, that these regimes should be applied to monitoring and enforcing CCS demonstration and that the Environment Agency (EA) is well placed to provide this function. In their response, EA said that they would welcome this role. They described how existing frameworks provided a link between the existing process for annual EU ETS returns, which are validated by third parties, and regular site visits for compliance or advice, which they conduct as part of operating permit requirements.
- 2.44 Industry respondents tended to emphasise that any additional requirements should not be too burdensome, should be flexible and agreed on a case-by-case basis with EA. Of the options considered for monitoring, industry generally believed that regular reporting to the consenting body and monitoring of carbon dioxide storage could be implemented in tandem. They thought that the option of monitoring through an indicative EPS would represent additional burdens and would not reflect the risks across the entire CCS chain.

- 2.45 Many NGOs argued that an EPS should be set now and used as the basis of monitoring efforts. Some of these respondents agreed that the EA should be empowered to take on the monitoring role and that strict legal consequences should be used to enforce any breach of emissions limits.
- 2.46 Many responses, from industry, NGOs and other organisations, suggested that effort should be made to create a monitoring framework that allowed international comparison to facilitate sharing and dissemination of learning with other participants in the wider, international demonstration effort.
- 2.47 Other points raised in answers to this question included:
- CCS demonstrations should be monitored in terms of the ‘design of experiment’ and not entirely on outcomes due to the higher level of risk for early demonstration stage projects.
  - The consenting body should not have a monitoring role.
  - Monitoring data should be kept in the public domain.
  - It is vital to ensure that monitoring equipment on different parts of the chain is interfaced and operated flexibly.
  - The British Geological Society was well placed to monitor storage.

#### Consultation Question

**4.4 Under which circumstances would you consider it acceptable and/ or necessary for power station operators to switch off the CCS chain? Please provide evidence to support your views.**

- 2.48 The general view was that it would be acceptable to switch off the CCS chain under certain circumstances. A range of circumstances were proposed including:
- Implementing improvements/alterations (maintenance/repair).
  - Unacceptable health and safety situations.
  - Security of supply or grid stability issues beyond the operator’s control e.g. when demand is high or other generators are suddenly unavailable.
  - Possible teething problems in the early years of a new plant.
  - Plant testing and monitoring.
  - Risk to the natural environment.
  - The storage reservoir is (unexpectedly) full.

- 2.49 Some respondents thought that the CCS chain should not be switched off purely for economic reasons, with a suggestion that there should be strict contractual terms to prevent switch-off for this reason. Some NGOs thought that where technical issues resulted in switching off the CCS chain, the whole plant should be switched off to prevent carbon dioxide being emitted in the manner of a conventional coal plant.
- 2.50 Some other points made in response to this question included:
- Some argued that it should be for operators to decide when to switch off the CCS chain. There was also a suggestion that the National Grid and the Environment Agency together could make a decision about when security of supply issues could temporarily justify cutting off the CCS chain.
  - Derogations should be given to new CCS projects for a period to recognise teething problems of demonstration projects.
  - Circumstances in which CCS could be switched off need to be agreed in advance of investment decisions.
  - Shutting down the amine regeneration element of the capture process would allow increased abated generation during peak demand times.

#### Consultation 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? Please provide evidence to support your views.**

- 2.51 This question received a broad range of responses. The area of general agreement was the need to define clearly what is meant by 'reasonable efforts'. A large number of respondents, particularly, but not exclusively, from industry, stated how clarifying 'reasonable efforts' would be necessary to enable developers to assess the risks for investment in CCS demonstration and to inform operational decisions once CCS demonstration projects are up and running.
- 2.52 The predominant view from NGOs and a few other organisations was that the introduction of an EPS would negate the need for such definitions and provide a transparent and absolute condition that should be met. In the absence of an EPS, NGOs agreed that power stations should be closed if reasonable efforts were not made.
- 2.53 Most industry respondents felt that the threat of closure was a draconian measure and would deter investment in CCS and encourage investment in existing coal stations or new gas-powered stations rather than new coal, given the stage of development of the technology and the associated risks. Industry and other commentators expressed the view that the financial incentive would be a strong enough incentive for operators to make reasonable efforts to run the CCS chain, meaning that no penalties for failure would be required. Several comments from industry said it would be reasonable to expect any public funds to be returned should reasonable efforts not have been made.

2.54 Other comments made in response to this question included:

- The onus of responsibility should be to determine that the operator has ‘failed’ rather than for the operator to prove they had made ‘reasonable efforts’.
- It is unfair and a risk to investors to close the entire plant if the capture unit has failed on only part of it.
- In the event of failure, a plant would be constrained by the EU ETS and under the constraints of their environmental permit.
- There should be a mechanism for a new third party to take over the running of the capture unit in the event that it had failed.
- There would be financial repercussions on pipeline and storage operations if operation was ceased at coal power stations.

Requiring retrofit

#### Consultation Question

**4.6 Do you agree, in principle, that there should be a requirement to retrofit? Please provide evidence to support your views.**

- 2.55 There were a wide range of views on the requirement to retrofit. Those respondents who agreed with the requirement frequently qualified their support, by stating that they only agreed under certain circumstances. A number of responses, including from industry, believed that any requirement to retrofit would need to be supported by financial and other incentives in order to avoid it acting as a barrier to investment in coal-fired plant. CCS investment should be supported by a market framework rather than regulatory requirements that could be seen as burdensome and discourage investment. Many industry respondents argued that the EU ETS should be the primary mechanism for driving emissions reductions in the power sector and a decision on whether to make retrofitting a requirement should be left to when the technology has been demonstrated on a commercial scale and is technically and economically proven.
- 2.56 Some responses from industry argued that a requirement to retrofit needs to be more accurately specified with greater certainty over funding and clear timelines linked, for example, to wide-scale deployment of CCS and 2030 decarbonisation goals, which would allow for the development of a business case and an investment decision. Some industry respondents also stated that the requirement should extend to new gas power stations.
- 2.57 NGOs and many individuals were of the view that ensuring full CCS on all plants would best be achieved through the application of an Emissions Performance Standard (EPS). This would provide greater flexibility for companies in meeting climate goals and signal Government’s intention to comply with decarbonising the electricity sector by 2030. Setting an EPS now and then tapering it would, it was argued, steer low carbon investment and reduce the future cost of retrofit on the public purse.

2.58 Other points made on a requirement to retrofit included:

- A strong contingency measure in the 2020's would, they argued, negate the need for a requirement to retrofit.
- Additional regulation would lead to increased costs to consumers and reduced environmental benefits.

#### Consultation 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? Please provide evidence to support your views.**

2.59 There were many views but no consensus on the criteria that should form the basis of an assessment of when CCS is technically and economically proven.

2.60 There were varying views on the use of Best Available Techniques (BAT) in assessing when CCS is technically and economically proven. Some respondents thought the 'BAT' approach should be used because the information exchange within the BAT reference process allows a wide range of stakeholders to be engaged and enables relevant data, including from outside the EU to be taken into account. The criteria used in the BAT reference documents could be used to help determine whether CCS is technically and economically proven.

2.61 Some NGO respondents said they were opposed to BAT criteria being used. They argued that climate change science should dictate regulation regarding coal, not the availability of carbon abatement technologies and that BAT was complicated and has limited success in driving technology forward. Instead, NGOs believed that introducing an EPS would mean there is no need for a test.

2.62 Other *general* points given on the criteria of when CCS is *technically and economically* proven included:

- It should be based on clear, well understood criteria before investment is made.
- After the demonstration programme, it should be the market that decides if CCS is technically and economically proven.
- The timescale for a review of CCS technologies is important as it should be initiated in time to report in 2020. It may conclude that further experience is required before a decision can be reached.
- A blanket decision on CCS technology being proven should not be made. Different technologies should be assessed separately so that delays in one do not hold up progress with another.
- Establishing such criteria is not justified at this stage.

- If the assessment is based on the assertion that CCS will be proven by 2020, the obligation should be to show that it is not proven as this is more straightforward than demonstrating it is proven.

2.63 Suggestions from respondents on the criteria that should form the basis of when CCS is *technically* proven included:

- When equipment suppliers are prepared to offer robust performance guarantees and insurance companies offer business interruption cover at commercial rates.
- Consider each element of the value chain separately and apply different criteria to different technologies.
- Capture will be technically proven ahead of storage as viability of storage sites will take much longer to verify and may be impossible to determine generically as all storage locations have different characteristics.
- Consider CCS demonstrations taking place elsewhere in the world.
- Use performance measures e.g. carbon abated, availability, reliability, health and safety, start-up and shut down timescales, heat and power requirements, maintenance requirements, carbon removal efficiency and scalability and ability to be constructed and operated in a variety of scenarios.

2.64 Suggestions from respondents on the criteria that should form the basis of when CCS is *economically* proven included:

- Rely on investor decisions. Should demonstrate that the cost of construction and ongoing operating costs for the full CCS chain can be recovered based on agreed set of generic market assumptions, e.g. carbon price, fuel prices, power price, plant load factor profile, cost of capital, plant life, transport costs, cost of storage. Technology should be available from a number of suppliers.
- There might not be a single point of judgement, but it could be when CCS represents good value for money in relation to the cost of carbon abated for other low carbon technologies e.g. wind.
- Transparent and rule based, non-site specific, focused on value for customer and forward looking.
- Economically proven could mean a degree of cost certainty or a level of profitability.
- No judgement on commercially proven should be made unless there is an equivalent requirement to fit CCS to gas plant.
- Does it matter if CCS is not economically proven? It is difficult to put a price on our efforts to save the world because we have an obligation to save it.



Consultation Question	
4.8	<b>Do you agree that the Environment Agency should be tasked with assessing when CCS is technically proven? Please provide evidence to support your views.</b>

2.65 There was broad agreement from respondents that the Environment Agency (EA) should be tasked with assessing when CCS is technically proven.

2.66 Reasons given for this included:

- EA has the experience and technical competence to review CCS technology as it exists specifically to apply environmental standards to industrial and other potentially polluting activities.
- EA is already accustomed to using the current technique for identifying the most effective technologies - BAT which has been agreed across the EU under the Integrated Pollution Prevention and Control Directive.

2.67 Other points made included:

- EA must have resources to perform this highly technical task.
- There must be close consultation with industry.
- For offshore operations EA may need advice from DECC and the Health & Safety Executive (HSE).
- EA should work with the Scottish Environment Protection Agency to provide a common approach across England, Wales and Scotland.

2.68 Some respondents from industry and trade associations had concerns about whether EA should be tasked with assessing when CCS is technically proven and instead suggested alternative options. These included:

- The Office of Carbon Capture and Storage in DECC should be tasked with the assessment and consider evidence from other countries while consulting widely including with EA.
- Create a new body containing technical experts across industry. Alternatively, use an existing organisation that has expertise e.g. United Nations Framework Convention on Climate Change.
- Government should work with the International Energy Agency so the determinants could be used in other countries.

Consultation Question	
4.9	<b>Who do you think should be tasked with judging when CCS is economically proven? Please provide evidence to support your views.</b>

- 2.69 There were a variety of suggestions provided on who should be tasked with judging when CCS is economically proven. Ofgem, the Climate Change Committee (CCC), Government, the Environment Agency (EA) and investors were all named as possible organisations capable of performing the task.
- 2.70 A number of industry respondents thought that Ofgem should be given the task to judge when CCS was economically proven, as they are the proposed management agency for the CCS levy and have relevant experience (they administrate the Renewables Obligation). Ofgem and some other respondents argued that such an assessment was best left to market investors who are best placed to handle price risks, adding that investors will respond if the carbon price is sufficiently high and certain. Ofgem said it was willing to contribute expertise to a review if required. Others thought that the behaviour of investors should provide a clear indication of whether the technology is commercially viable.
- 2.71 Some respondents believed the CCC has the appropriate level of economic competence to judge when CCS is economically proven or could provide independent advice on the subject to Government who could then make a decision. A few respondents believed that DECC/Government officials should make the decision because they had access to relevant market information and knowledge of level of support.
- 2.72 Some respondents mentioned that EA should have a role in judging when CCS is economically proven. In their response EA believed they could assess the economic implications of running a CCS plant, but that the CCC or DECC was better placed to advise on future coal prices.
- 2.73 Other points made in response to who should judge when CCS is economically proven included:
- Various collaborations suggested e.g. EA and CCC to combine BAT with an understanding of the economics of climate change.
  - The body should be independent.
  - The operator or developer should decide themselves when CCS is economically proven.

Consultation Question	
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<b>4.10</b>	<b>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? Please provide evidence to support your views.</b>
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- 2.74 There were mixed opinions in response to this question. Many responses from industry stated that Government, on the basis of independent advice, should make the decision of when CCS is proven, as decisions on whether and when to mandate CCS on new plant should ultimately be left to Government (DECC) to decide. However, there should also be ongoing discussions between operators, Government and other stakeholders so an informed decision could be made.
- 2.75 Some NGO and other responses preferred an independent body to decide when CCS is proven but if the decision is taken by Government, then any independent advice should be made available publicly in order to avoid accusations of political bias.
- 2.76 Other points made in response to this question included:
- EA or CCC should make the assessment of when CCS is proven with advice from other countries.
  - The organisation should be a different body to those carrying out technical and economic tests.
  - The decision should be avoided. Government should confine itself to defining emission regimes and EU ETS developments, leaving investors to determine which CCS technology to support and when.
  - Responsibility should be divided across three independent bodies – one technical, one economic and one with an overall view on the assessment of proven.

Consultation Question	
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<b>4.11</b>	<b>Do you agree that the Environment Agency should implement any requirement to retrofit CCS through the Environmental Permitting regime? Please provide evidence to support your views.</b>
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- 2.77 There was broad agreement that the Environment Agency (EA) should implement any requirement to retrofit CCS through the Environmental Permitting regime. EA supported this in principle saying that it already regulates all coal and gas plants above 300MW by permits granted under the Environmental Permitting regime. Because of this existing role, EA has the regulatory and technical experience to implement this requirement.
- 2.78 One concern raised was that the Environmental Permitting regime does not allow setting of Emission Limit Values for carbon dioxide for plant already covered by the EU ETS and that whilst the EA can make its own BAT assessment, this would not currently be in line

with EU legislation. However, it was also mentioned that Article 176 of the EC Treaty gives the right of EU member states to establish more stringent environmental standards nationally. Some NGOs restated that the best signal for a requirement to retrofit was through the adoption of boiler based EPS and that using the Environmental Permitting regime seems a sensible place for this requirement to be placed.

2.79 Other points made in response to this question included:

- This requirement would allow any site specific factors to be taken into account.
- The policy should not be subject to further tightening and interpretation as part of the Integrated Pollution Protection & Control (IPPC) Directive process.

#### Consultation Question

**4.12 What are your views on how the requirement to retrofit should apply to existing coal power stations? Please provide evidence to support your views.**

2.80 Many respondents, particularly from industry, thought that existing coal power stations were not viable candidates for retrofit, other than for the purpose of demonstrating CCS, with a few responses saying outright that they thought existing plants should not be required to retrofit. Reasons for this were that existing plants were not capture ready, but were old and relatively inefficient and likely to be retired in the near future due to the Large Combustion Plants Directive, Industrial Emissions Directive and the EU ETS. Those power stations that upgrade and fit super critical technology might run at lower load factors meaning it would not be economic to retrofit CCS to existing coal plants. The focus should be on new coal power stations and using existing power station sites for new coal plants to make use of the existing infrastructure and access to the coast.

2.81 Many NGO responses and some from industry expressed views in favour of requiring existing coal plants to retrofit. Reasons for this were that retrofitting would provide clarity for new and old coal plants on emissions constraints and would improve economies of scale whilst encouraging the development of shared infrastructure. Many NGO respondents argued that the establishment of an EPS was the most effective way of securing retrofit or equivalent emission reductions. Some respondents also had the view that all fossil fuel power stations should operate in the same regulatory environment as coal.

2.82 Other points made in response to this question included:

- Similar principles should apply to the regulatory framework for carbon dioxide emissions as to that for reducing sulphur dioxide and nitrogen oxides – a longer notice period and the opportunity to reduce emissions by reducing annual operating hours with an end stop date for fitting CCS equipment.
- Clarity and well-defined timescales were needed to enable business and industry to plan accordingly and build up required resources.
- A phased approach to retrofitting would be required.

- The mechanism to justify retrofit of existing plant is already present in the Environmental Permit and the requirement to justify use of BAT.
- Retrofitting should be a commercial decision for existing plant operators based on prevailing energy and carbon market conditions. It may not be safe to retrofit to existing plant - pressure to fit in insufficient or unsuitable space could impact safety.

## Contingency

### Consultation Question

**4.13 Do you agree, in principle, that there is a need for a contingency measure? Please provide evidence to support your views.**

- 2.83 There was a wide range of often strong views on the need for a contingency measure. Responses from industry tended to believe a contingency was likely to discourage investment in new coal power stations and CCS development, due to a risk of stranded assets. Responses from many NGOs believed a contingency was crucial to ensure future emissions were reduced.
- 2.84 Many industry respondents were critical and unclear as to why a contingency measure was needed as coal plants will need to operate under a tightening EU ETS cap and some plants were due to close in the next decade. They saw the EU ETS as the contingency, meaning that if CCS was not proven then the EU ETS should be the default scheme to limit carbon dioxide emissions from coal power stations within an overall agreed cap. Some industry respondents argued that a contingency measure would undermine the EU ETS and suggest a lack of confidence in CCS.
- 2.85 Industry respondents believed that if the right financial conditions were in place quickly to demonstrate CCS, there would be no need for a contingency measure. If they are not, there would be no investment anyway. A few industry respondents went as far as to say that a contingency measure was not a viable option and would be self defeating and damaging for the UK if we proceeded in isolation from other countries. Conversely, a few industry responses said that if there must be an EPS it should be specified now so it could be factored into investment appraisals.
- 2.86 Some respondents, mainly NGOs and individuals, but also a few operators, saw a contingency as crucial in order to provide certainty on the pathway to decarbonisation. They argued that such a measure would provide confidence to the industry and drive investment in CCS. NGO respondents proposed a joint position on introducing an Emissions Performance Standard at once and limiting carbon dioxide emissions for all new generating plants at 300g/kWh and tapering this to 100g/kWh in 2025, which would give a strong regulatory signal for coal and gas plants.
- 2.87 Other points made about a need for a contingency included:
- Any contingency should apply to gas as well as to coal; otherwise investment would switch to building gas.

- The role of the EU ETS to encourage low carbon technology in general would be put at risk by introducing a contingency measure.
- Additional regulation, risks increasing costs to consumers without delivering environmental benefits as the emissions will occur elsewhere in Europe.
- There could be a place for a restricted hours derogation for existing plants.
- There should be flexibility to allow a limited number of advanced coal plant without CCS to be deployed to ensure security of supply if CCS is delayed.

#### Consultation 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? Please provide evidence to support your views.**

- 2.88 There was general disagreement with the introduction and design of any contingency measure being subject to an independent review in 2020. Those respondents who did not see a need for a contingency measure in the first place subsequently did not agree with the proposal in this question either. These, mainly industry respondents, instead believed that a continuous review of the development of CCS technology alongside other low-carbon sources should be performed. They also thought that setting a commitment to undertake a formal independent review in 2020 (or before, in 2016) that takes stock of the current role of CCS in the energy mix and its potential for the future would be highly advantageous. One point made was that the EA should be continuously in a position of understanding the status of CCS technology in the UK through the demonstrator plants having to report into them. This would mean a formal independent review was unnecessary.
- 2.89 Many NGOs and a few industry respondents strongly disagreed with the introduction of a review. They believed that a review designed to report in 2020 signals that the Government is unwilling to take strong decisions on climate policy and is not confident about the future development of CCS. Clear regulation must be introduced now to ensure coal power plants will not be able to operate in the future unless they meet absolute emissions standards. This would then deliver climate and investor confidence - any potential investor in a CCS plant would need to be able to fully assess the likely impact of any future measures on its original investment decision.
- 2.90 In contrast, there were a few respondents, including some from business and operators, who were in agreement with the principle of an independent review of the introduction and design of any contingency measure in 2020, although some thought a review should be earlier e.g. in 2015/16 ahead of the 2017 statutory emissions review. Some respondents said it was simply premature to assess when an independent review is required at the moment, but would support the publication of a review later if deemed necessary.
- 2.91 Some respondents from various organisations thought the Government should be making the decisions about the introduction and design of any contingency measure.

Consultation Question	
4.15	<b>Which aspects of any contingency should be defined through a review, and which should be defined now? Please provide evidence to support your views.</b>

2.92 The majority of NGO respondents thought that the principle of a contingency should be defined now along with the objective it is designed to achieve e.g. meeting a 2030 decarbonisation goal. Various respondents thought that if a contingency was set now, the fullest details should also be provided now in order to give investor certainty. Suggestions on the aspects of a contingency which respondents said could be defined now included:

- The nature of the contingency mechanism e.g. carbon dioxide cap, running hours or EPS.
- Restrictions that will apply from the date a contingency takes effect and procedures and timetables for reviews.
- An EPS threshold, breach of which would mean a fee would have to be paid and the revenue used to fund CCS projects.
- Showing how a contingency could reward investment in CCS and incentivise retrofit (when economic and technical conditions allow).

2.93 A number of responses suggested that emissions from gas plant should be used as a benchmark for defining any contingency measure.

2.94 Some responses, mainly from industry, argued that it was currently inappropriate to define aspects of a contingency before CCS was operating at a commercial scale. It was thought that arguments as to the relative merits, for example, of caps on running hours or an EPS would be better made once the demonstrations projects were underway.

2.95 In addition, and similar to the responses to Questions 4.13 and 4.14, many industry respondents did not believe a contingency measure was appropriate. They did think a periodic review of CCS development would be valuable and should focus on the economic viability of CCS in relation to the emissions market development. It should seek to assess whether the market has become sufficiently robust to underpin CCS investment and it should inform policy makers on market adjustments needed to ensure rapid deployment of CCS.

2.96 Suggestions to the aspects of a contingency which should be defined through a review included:

- The quantitative measures to be applied.
- Whether further incentives are required for CCS development.
- Global CCS progress as UK action alone would be pointless.
- Progress in meeting targets.
- Prognosis for carbon prices in the ETS.

## Funding a UK CCS Demonstration Programme

## Consultation 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? Please provide evidence to support your views.**

2.97 A significant proportion of respondents answered these questions, including operators, business and NGOs. The majority were broadly supportive of our proposal that CCS demonstration projects should be funded through a levy on electricity suppliers.

### Raising funds through a levy

2.98 Some of the key points made regarding the levy included:

- **EU funding:** Respondents commented that the financial mechanism should supplement EU funding and be coordinated with finance available at the EU level. Some respondents noted that the UK needs to ensure that the arrangements for disbursing EU funds align with projects to be supported in the UK. Some thought there was scope to obtain support for at least two UK projects under the EU ETS Directive provisions to allocate 200 million EU Allowances to CCS from the New Entrant Reserve for Phase III.
- **Flexibility:** Some industry respondents were keen that the levy be designed to provide maximum flexibility going forward, e.g. the potential to be extended to fund the retrofit requirement on demonstration projects and full CCS deployment in the future. Some respondents commented that adopting a levy approach makes this possible as it could respond effectively to changing market conditions and cost reductions in CCS technology.
- **Deployment:** Some respondents, particularly industry, wanted confirmation of a longer-term plan beyond the demonstration, for the mechanism to fund retrofit and wider deployment.

2.99 Many responses mentioned the transparency of costs to consumers with the need to balance short term and long term value for money. Some responses suggested other methods of support that could enable Government to reduce the costs to consumers including accelerated depreciation, enhanced capital allowances and exempting CCS electricity from the Climate Change Levy.



## Dispersing fund through a Contract for Differences (CfD)

- 2.100 Of the many respondents that commented most agreed that the Contract for Differences (CfD) was an appropriate model for a disbursement mechanism as it has a number of advantages compared to the other options presented including removal of carbon price risk for projects and potential for levy costs to reduce over time, which helps protect consumers from additional costs.
- 2.101 A few respondents felt that a hybrid approach was required that incorporates upfront capital payments alongside operational payments (either CfD or Feed-in Tariff). Some responses argued that upfront capital support from Government will reduce the risks for developers and so the total costs of the project, increasing overall value for money of the project. One suggestion was that this could be in the form of grants that electricity companies pay back at a later date.
- 2.102 Other points made on the CfD and the financial support mechanism included:
- Duration of support – the 15 years proposed is less than the commercial life of projects, a small number of respondents suggested extending the support period to 20 years.
  - Limited scope of applicability – could also cover other hydrocarbon fuels such as natural gas industrial CCS power projects and other large industrial point source emitters.
  - Different risk profiles – between existing generators and new entrants. New entrants should not be disadvantaged.

### Other issues

- 2.103 Other issues highlighted in response to this question included:
- There was disagreement over whether this financial mechanism should cover just CCS demonstrations on electricity generation for the grid or other applications as well. Suggestions included energy efficiency projects, hydrocarbon fuel generation, underground coal gasification (UCG) and industrial applications such as steel. Some respondents noted the importance of considering the impact the financial mechanism could have on the competitiveness of other energy intensive industries.
  - The benefits of a Renewable Obligation type incentive over a levy based scheme.
  - The need to be clear on the amount of money available and the number of projects it will support as early as possible.
  - Some NGOs opposed the idea that consumers should ultimately fund use of CCS as they were concerned this may reduce support for energy efficiency and renewables and that it could impact fuel poverty.

Consultation Question	
5.2	<b>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? Please provide evidence to support your views.</b>

2.104 In response to this question, a range of responses from industry and trade associations highlighted that selection of CCS demonstration projects should be both competitive and transparent with a focus on developing a fast, streamlined process. In order to achieve this, a number of respondents suggested that there should be just one call for the additional demonstration projects as opposed to separate calls for each project and suggested that Government should not announce specific calls for different technologies that could lead to sub-optimal projects. Some respondents also noted that the selection of projects needed to take account of EU level competitions.

2.105 The consultation included a set of potential criteria for selecting projects and there was general agreement on these. A range of additional selection criteria were also suggested by respondents. The two key criteria were value for money, possibly based on both volume and cost of carbon dioxide abated, and the speed of project delivery i.e. readiness to proceed. Respondents also commented that Government needs to be clear on which criteria are the most important for the selection of projects.

2.106 Other suggested criteria for selecting and managing CCS demonstration projects included:

- Likelihood of forming clusters.
- Ability to stick to EU timescales.
- Ability to meet health & safety and environmental regulations.
- Located to minimise future impact on wildlife.
- Ability to create a net reduction in UK greenhouse gas emissions.

2.107 For management of the demonstration programme, many respondents agreed that Ofgem should take on the role of management agency. Other suggestions included an independent agency and the Office of CCS.

## Maximising the benefits to a low carbon economy: a strategic role for Government

## Consultation 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? Please provide evidence to support your views.**

- 2.108 Responses to this question expressed two opposing views on how the CCS demonstration projects could make the most cost effective contribution to carbon dioxide infrastructure.
- 2.109 One view expressed by some industry and trade association respondents was that carbon dioxide pipelines should be oversized as part of the demonstration programme. Opinions ranged from the need to build carbon dioxide pipelines of sufficient size for the whole plant (ready for retrofit) to building pipelines capable of supporting other capture projects in the area and so developing a carbon dioxide network around the original demonstration plant. Advantages claimed for this approach included the potential to increase the speed of CCS development, help put UK businesses at a competitive advantage, long term cost savings via economies of scale and also the opportunity to demonstrate and better understand how a regional carbon dioxide network will work. Some respondents thought that oversized pipelines should be promoted through some other support mechanism e.g. direct subsidy or guaranteed interest on bonds, with the pipelines possibly owned and operated by a separate entity.
- 2.110 The other view expressed by respondents was that over-sizing of pipelines was not essential for the demonstration programme. They argued that the volume of carbon dioxide collected as part of a demonstration is not enough to justify the cost of larger pipelines and it could lead to additional risks of stranded assets and market distortions.
- 2.111 As discussed in the consultation document, there were suggestions that if pipelines were developed as point to point they should also have a requirement for 'open season' bidding arrangements for pipeline capacity and possibly provide taps that will allow private investment in pipeline capacity at additional or marginal cost and access to third parties. Some responses noted that successful demonstration projects could invest in over-sizing pipelines based on their own confidence in the market and that Government should encourage developers to privately invest in transport networks.
- 2.112 Other issues raised in response to this question included:
- Demonstration projects should be selected if they have the potential to contribute to the development of a large 'cluster' of carbon dioxide emitters.
  - There may be some areas where existing pipeline infrastructure can be re-used.
  - There is a need to have the regulatory regime for carbon dioxide transport in place as soon as possible including licensing and contractual agreements.

Consultation Question	
6.2	<b>What are your views on how can we best ensure that CCS business clusters are encouraged, maximising the future opportunities for UK business? Please provide evidence to support your views.</b>

2.113 Responses to this question mainly suggested ways in which the selection of the demonstration projects could encourage the development of CCS business clusters. Ideas included:

- Ensuring projects are located in diverse geographic regions where large scale emitters occur or new power stations could be developed, creating the basis for up to four CCS regional infrastructure networks. It was recognised that there are risks to this approach, as many existing power stations will close in the next 5 – 10 years and so the focus should be on the location of new power stations and other carbon dioxide sources.
- Encourage/support early investment in pipeline over-sizing, and encourage network formation.
- Support the full range of technologies to increase learning and skills capacity development.
- Suggestions that two of the demonstrations should be co-located to develop a project with shared infrastructure in order to give some initial experience in the design, construction and operation of an integrated carbon dioxide network.

2.114 A range of other comments were made in relation to encouraging business clusters:

- Steady growth in the number of demonstration projects rather than a stop start approach. This would allow more sustained growth in CCS business development.
- There is support for the work being done by the RDAs on cluster development.
- Government should work more closely with the oil and gas industry on this.
- There is a need to stimulate R&D in order to increase investment around centres of engineering excellence. The Energy Technologies Institute (ETI), Technology Strategy Board (TSB) & Environmental Transformation Fund (ETF) all have a role to play in developing CCS clusters.
- CCS Low Carbon Areas could be announced as part of the CCS Strategy.
- Ongoing and appropriate knowledge sharing and dissemination.

Consultation Question	
6.3	<b>Are there any other actions that the Government should consider taking at this stage to prepare for the full commercial deployment of CCS? Please provide evidence to support your views.</b>

2.115 There were a number of further actions that respondents thought the Government should consider taking to prepare for the full commercial deployment of CCS. They included:

- Developing a public information campaign to help public understanding and acceptance of CCS.
- Supporting CCS R&D in UK, Europe and developing countries.
- R&D funding should be restricted to plants with 100% CCS.
- Developing a strategic programme for skills development and re-training.
- Developing a CCS deployment roadmap and potentially a target or ambitious vision for CCS in the future e.g. ACCAT suggested that 10% of UK generation should come from CCS by 2020 which would require capacity amounting to 5GW.
- Working closely with the EU to support a robust carbon price and ensure UK & EU demonstration projects interact.
- Regulations should be introduced to prevent carbon storage being used to enhance oil recovery.
- Deciding how Intellectual Property (IP) from the demonstration programme will be shared in the UK and abroad.
- Considering whether more practical work is needed around storage including on saline aquifer capacity and clarifying licensing and leasing of carbon dioxide stores. Also considering the potential of importing carbon dioxide for storage and the potential use of shipping for early demonstrations.
- Making a life cycle analysis of emissions, such as methane from coal mines, part of the carbon capture demonstration process.
- Developing a long term regulatory framework e.g. how CCS pipelines will be managed and regulated.
- Considering long term financial support for CCS deployment.
- Releasing a clear statement on a requirement to apply CCS to gas.
- Developing the Office of CCS Development & Deployment (OCCS).



## Annex A: List of bodies who responded to the consultation

Advanced Power Generation Technology Forum (APGTF)  
Advisory Committee for Carbon Abatement Technologies (ACCAT)  
Alstom  
AMEC  
ARUP  
Association of Electricity Producers (AEP)  
Association of North East Councils  
Association of UK Coal Importers (Coal Imp)  
ATH Resources

BP  
British Association of Colliery Management (BACM)  
British Geological Survey (BGS)

Campaign to Protect Rural England  
Carbon Capture & Storage Association (CCSa)  
CBI  
Centrica  
C.GEN NV  
Chemical Industries Association (CIA)  
Christian Aid  
Client Earth  
CO2 DeepStore  
Coal Forum  
Confederation of UK Coal Producers (Coal Pro)  
ConocoPhillips  
Corus  
Costain Energy & Process  
Countryside Council for Wales  
Crown Estate

DCA Consultants  
Doosan Babcock  
Drax Power Limited

EDF Energy  
EEF  
Energy Institute (EI)  
Energy Research Partnership (ERP)  
English Regional Development Agencies  
Environment Agency  
E.ON  
ESB International (ESBI)

Fife Energy Ltd

GE Infrastructure  
GMB

Good Energy  
Green Alliance  
Greenpeace  
GrowHow UK

Health & Safety Executive (HSE)  
Hydrogen Energy

Institution of Chemical Engineers (IChemE)  
Institution of Civil Engineers  
Institution of Engineering and Technology  
Institution of Mechanical Engineers  
International Power

Kingsnorth Climate Action Medway (KCAM)

Make Poverty History North East & PANiC Stations  
Merseyside Environmental Advisory Service  
Mineral Products Association – Cement (MPA)

National Grid  
National Union of Mine Workers (NUM)  
Natural England  
North Ayrshire Council  
North East Chamber of Commerce  
Northern Way

OFGEM  
One North East

Peel Energy  
Plymouth Marine Laboratory  
Powerfuel  
Progressive Energy

Rio Tinto Alcan  
Royal Academy of Engineering  
Royal Society of Edinburgh  
Royal Town Planning Institute (RTPI)  
RSPB  
RWE

Schlumberger  
Scottish & Southern Energy (SSE)  
Scottish Environment Protection Agency (SEPA)  
Scottish Government – Minister for Enterprise, Energy & Tourism  
Scottish Natural Heritage (SNH)  
Scottish Power  
Scottish Resources Group  
SembCorp Utilities (UK)  
Shell  
Sir Joseph Swan Institute, Newcastle University



Sussex Energy Group

Tees Valley Joint Strategy Unit

TUC

Tullow Oil

TUV NEL Ltd

UCG Partnership

UK COAL Mining Limited

UK Energy Research Centre (UKERC)

Welsh Assembly Government

World Coal Institute

World Development Movement

WWF

Yellow Wood Energy

Yorkshire Coal Task Force

Yorkshire Forward / CO2 Sense

## Annex B: Consultation questions

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

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? Please provide evidence to support your views.

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? Please provide evidence to support your views.

3.3 What are your views on the proposed objectives of the UK CCS demonstration programme, including the scale of individual demonstration projects? Please provide evidence to support your views.

3.4 What are your views on whether and how an emissions performance standard (EPS) could support our policy objectives? Please provide evidence to support your views.

### Chapter 4: The proposed regulatory framework

4.1 Do you agree, in principle, that new coal power stations should be required to demonstrate CCS? Please provide evidence to support your views.

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? Please provide evidence to support your views.

4.3 What are your views on the best approach to monitoring the operation of CCS demonstrations? Please provide evidence to support your views.

4.4 Under which circumstances would you consider it acceptable and/ or necessary for power station operators to switch off the CCS chain? Please provide evidence to support your views.

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? Please provide evidence to support your views.

4.6 Do you agree, in principle, that there should be a requirement to retrofit? Please provide evidence to support your views.

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? Please provide evidence to support your views.

4.8 Do you agree that the Environment Agency should be tasked with assessing when CCS is technically proven? Please provide evidence to support your views.

4.9 Who do you think should be tasked with judging when CCS is economically proven? Please provide evidence to support your views.

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? Please provide evidence to support your views.

4.11 Do you agree that the Environment Agency should implement any requirement to retrofit CCS through the Environmental Permitting regime? Please provide evidence to support your views.

4.12 What are your views on how the requirement to retrofit should apply to existing coal power stations? Please provide evidence to support your views.

4.13 Do you agree, in principle, that there is a need for a contingency measure? Please provide evidence to support your views.

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? Please provide evidence to support your views.

4.15 Which aspects of any contingency should be defined through a review, and which should be defined now? Please provide evidence to support your views.

## **Chapter 5: Funding a UK CCS demonstration programme**

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? Please provide evidence to support your views.

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? Please provide evidence to support your views.

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

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

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? Please provide evidence to support your views.

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? Please provide evidence to support your views.

## Annex C: Related Documents

These documents are published alongside this consultation response, and are available from [www.decc.gov.uk](http://www.decc.gov.uk).

- A Framework for the Development of Clean Coal – Final Impact Assessment.
- Strategic Environmental Assessment for a Framework for the Development of Clean Coal – Post Adoption Statement.
- Draft Supplementary Guidance for Section 36 Electricity Act 1989 Consent Applicants for Coal Power Stations. Published for consultation.
- Carbon Capture and Storage demonstration: analysis of policies on coal/CCS and financial incentive schemes. Redpoint.

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