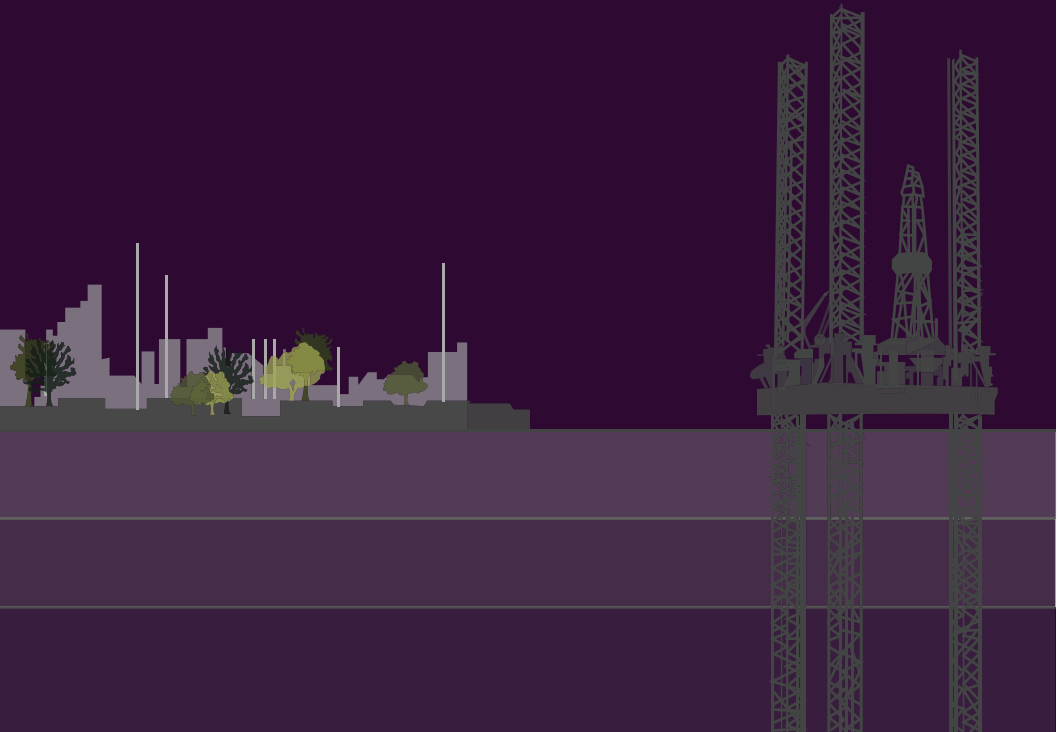


# Carbon Capture and Storage

## Developing a commercial and financial framework

by Ecofin Research Foundation with ETI support  
2013 progress review



## Why Carbon Capture and Storage?

When addressing long term emissions reduction targets, Carbon Capture and Storage (CCS) is one of two critical levers (alongside bioenergy) in delivering an affordable, secure and sustainable UK energy system.

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## Carbon Capture and Storage: developing a commercial and financial framework

By Ecofin Research Foundation with ETI support - 2013 progress review

### Introduction

Throughout 2013 the Energy Technologies Institute (ETI) and Ecofin Research Foundation (ERF) worked together to progress the development of a commercial Carbon Capture and Storage industry in the UK.

The ETI and ERF's joint initiative on mobilising private sector finance for CCS in the UK began in 2012. The initial work involved canvassing the view of key stakeholders, including potential private sector capital providers, project developers and policy makers to assess the conditions needed to encourage private sector investment in CCS. At the end of 2012 the results of this work were published in a report that has been disseminated widely and is available for download from the ETI and ERF websites.

To ensure ongoing engagement with key stakeholders the ETI and ERF established a Steering Group of key finance and insurance sector professionals, project developers and policy makers. This group has provided input to the Department of Energy and Climate Change (DECC) on Electricity Market Reform issues relevant to CCS.

As we provide a bridge between financiers and policymakers on CCS issues we were invited to be part of the CCS Cost Reduction Task Force established by the UK Government. The Cost Reduction Task Force published its final report with recommendations to help develop a CCS industry in the UK in May 2013.

## The Commercial Development Group

**“The Commercial Development Group is led by ERF with the support of the ETI ”**

In its report the UK CCS Cost Reduction Task Force recommended that three national leadership groups be set up to develop CCS in the UK. These groups are the Commercial Development Group, the Transport and Storage Development Group and the Knowledge Transfer Group.

Following the Cost Reduction Task Force recommendation, the ETI and ERF recruited additional members and expanded the scope of the ETI and ERF Steering Group to become the UK CCS Commercial Development Group.

The ETI and ERF have brought together an impressive range of key CCS stakeholders including potential financiers, insurers, project developers and policy makers that are most active in the UK CCS space.

The Commercial Development Group is led by the ERF with the support of the ETI. The other key organisations in the Group include the Crown Estate and the CCS Association. The ETI funded the ERF for its role as secretariat of the Commercial Development Group in 2013 and is continuing to do so in 2014.

The CCS Commercial Development Group recognises the role CCS has in abating carbon dioxide emissions and aims to secure ways, together with the UK Government, of making UK CCS projects bankable, and reducing the cost of capital of CCS projects.

The group consists of:

- Ecofin Research Foundation - Angela Whelan
- Energy Technologies Institute - George Day
- The Crown Estate (lead - CCS Transport and Storage national leadership Group) – Shabana Ahmad
- CCS Association (lead - CCS Knowledge Transfer national leadership group) – Luke Warren
- Department of Energy and Climate Change (DECC) – Brian Allison and Patrick Dixon
- Lloyds Bank – Alan White
- Societe Generale – Allan Baker
- BNP Paribas – Nick Gardiner
- Zurich (insurer) – John Scott
- National Grid (project developer, DECC commercialisation programme) – Jonny Hosford
- Shell (project developer, DECC commercialisation programme) – Belinda Perriman
- 2Co Energy (project developer, potential follow on project) – Jane Paxman
- Progressive Energy (project developer, potential follow on project) – Peter Whitton
- International Energy Agency – Wolf Heidug

## UK Electricity Market Reform

### “The CCS Commercial Development Group’s goal is to make CCS projects bankable”

While not officially part of the Steering Group the UK Green Investment Bank (Ian Nolan), Department for Business, Innovation and Skills (Ronnie Whittington) and the European Investment Bank (Christopher Knowles) are also involved with the group and provide input and attend meetings where relevant.

In carrying out its goal of making CCS projects bankable, the CCS Commercial Development Group works with the other two national leadership groups, the Transport and Storage Development Group and the Knowledge Transfer Group.

The Commercial Development Group focused on informing the new energy policies being developed in the UK as part of the Electricity Market Reform (EMR) in 2013.

### “These policies will have a major impact on the development of a CCS industry in the UK.”

Consultation on the UK Electricity Market Reform (EMR) continued in 2013 and further aspects of the policy and its implementation will continue to be developed in 2014. These policies could have a major impact on the development of a CCS industry in the UK.

Most of the policy development around EMR so far has focused on renewable energy and not CCS. However, the policies and conditions put in place for renewables will have implications for CCS. Given the importance of ensuring that these new policies do not become a barrier for the development of CCS in the UK, the ETI and ERF worked closely with the Commercial Development Group through workshops and one-on-one engagement to address aspects of the EMR that are likely to impact CCS. The Group provided input to the Office of Carbon Capture and Storage and the EMR teams at DECC and submitted a response to DECC’s Consultation on the draft Electricity Market Reform Delivery Plan (Appendix 1 and 2).

We have also been involved with CCS specific issues being developed as part of the EMR. We were part of DECC’s special stakeholder workshop on CCS and Nuclear Contracts for Difference (CfD) allocation. Following the workshop we worked with the Commercial Development Group to respond to the DECC EMR team’s specific questions on CCS CfD allocation (Appendix 3) We are also continuing to strengthen our links with the appropriate teams within DECC to help contribute to CCS policy development.

## Collaboration

### Other CCS Cost Reduction Task Force national leadership groups

**“ERF and ETI have also been working closely with the other key players in the CCS space both in the UK and at an EU level”**

In 2013 the ERF and ETI also worked closely with the other key players in the CCS space both in the UK and at an EU level.

We are also collaborating with the other national leadership groups to ensure that our work is complementary and shared between the groups. ERF and ETI are part of the Transport and Storage Development Group Steering Group and we are involved in planning the scope of work the Transport and Storage Development Group will undertake.

We will be working closely with the Transport and Storage Development Group once work on their three work streams (transport, storage and enhanced oil recovery) starts in 2014. The Transport and Storage Development Group is focusing on the technical issues while the Commercial Development Group is focusing and leading on the financial matters related to transport, storage and EOR.

The Knowledge Transfer Group is yet to be set up. ERF and ETI are already working closely with the Carbon Capture and Storage Association and others to ensure that all work done by the Commercial Development Group is disseminated widely by the Knowledge Transfer Group once it is established

### Zero Emissions Platform (ZEP)

Zero Emissions Platform established a Temporary Task Force on Storage and worked on addressing storage issues in 2013. The Task Force is developing a position paper which:

- Identifies the key enablers (and barriers) for any potential operator to offer their services in storing captured CO<sub>2</sub> from third parties on a commercial basis
- Presents feasible business models for CO<sub>2</sub> storage in the demonstration, pre-commercial and commercial stages, based on these enablers

The ERF and ETI are working with ZEP to develop thinking on commercial business models for transport and storage at an EU level.

The ZEP work informed the Commercial Development Group discussions on potential business models for the UK. We will continue this work in 2014 including engaging with the finance sector to develop bankable business models.

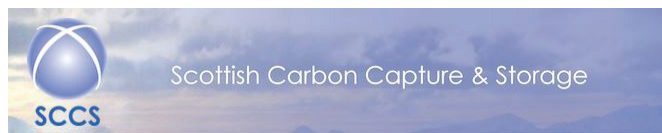
## Conferences

### Dissemination

Given our insight in issues around mobilising private finance for CCS, we were invited to participate at CCS conferences and events throughout 2013.

We used these opportunities to disseminate the main findings from the ETI/ERF joint initiative. Some of the events we presented at and contributed to include:

- All Energy Conference, Aberdeen – 22nd-23rd May
- Global CCS Institute Conference, Edinburgh – 23rd May
- Carbon Capture and Storage Technology in Europe Workshop, Brussels – 18th June
- Scottish CCS Conference – 12th September



## Going Forward

**“The ETI is funding ERF to carry on running the Commercial Development Group in 2014”**

The ETI and ERF will continue the joint initiative to help mobilise private sector finance for CCS. The ETI is funding ERF to carry on running the Commercial Development Group in 2014.

In order to identify the barriers to creating a CCS industry in the UK and help develop solutions to them, the team will work closely with the Commercial Development Group, the other national leadership groups and engage with the wider finance sector throughout 2014.

Key priorities will be to continue to develop Electricity Market Reform support for CCS and further work on regulatory, policy and insurance issues to mobilise private sector finance for CCS.

## Appendix 1

### Submission to DECC on key issues in Electricity Market Reform for CCS deployment

Submitted  
11th July  
2013

Market  
reference  
price, strike  
price, risk  
profiles and  
timing of  
decisions

Summary of points raised by the Energy Technologies Institute (ETI)/ Ecofin Research Foundation (ERF) project Steering Group on the UK's proposed Electricity Market Reform proposals in relation to Carbon Capture and Storage

**Market reference price** - Lenders will only have confidence in the reference price if it is achievable and at a level that together with the level of support received will enable the costs of the project to be recovered. A mechanism to underwrite the merchant risk could help solve these issues.

**Strike price** - Setting of the strike price will need to be made on a project by project basis as there is too much variation between CCS projects for standardisation. As the different CCS technologies carry different cost and risk structures, it's not a case of "one size fits all".

**Risk profiles** - The risk profile of projects that use established transport and storage networks will require different risk sharing mechanisms compared to new full chain "end-to-end" projects. Some of the risk sharing mechanisms of the Commercialisation Programme projects will also need to be retained on a project to project basis for the early projects outside Commercialisation Programme projects. This is particularly true for other "end-to-end" projects that are not plugging into established transport and storage infrastructure.

**Timing** - Early projects outside of the Commercialisation Programme are developing in parallel with the projects and will need to make decisions now and not wait for issues to be resolved by the Commercialisation Programme

Refinancing

- A requirement to gainshare is viewed as a major negative by potential capital providers as it removes an important incentive in taking the high risks associated with early CCS projects.

- Additionally, changes in the lending market have made it difficult to secure long term finance beyond 10 years. As such projects will have to refinance within 10 years and so risks are already being taken on what the market may look like in 10 years. Gainsharing is an additional penalty.

- Requiring gainshare is likely to result in a higher cost of capital for early projects.

CfD term

- A key issue for banks is the need to avoid market risk associated with cash flow from projects. Given the unproven operating regime of CCS projects, it is market practice for banks to require a tail in amortised financing to accommodate potential delayed repayment due to additional outages. As the CfD is likely to be a primary source of revenue for the project, the amortisation is likely to be based on the contract length.

- The bank market is currently constrained to circa 10 years for debt tenor. As such bank lending is able to work within the proposed 15 year CfD contracts as this supports the refinancing risk associated with the project.

- The large investment needed for CCS may require the involvement of capital markets (bonds, pension funds, Export Credit Agencies etc). These tend to work on longer timescales e.g. 20 years and the proposed CfD contract length of 15 years will not enable long-term funding to be obtained from these sources. The European Investment Bank (EIB) indicated that if an investment was linked to Power Purchase Agreements (PPA) and CfDs of a maximum tenor of 15 years then the EIB

## Appendix 1 continued

### CfD Term

would only consider 12 year lending rather than 15-20 years.

- A short term CfD (15 years or less) is also unlikely to enable the rating agencies to rate a project as investment grade, effectively shutting off the public bond market.
- The Green Investment Bank (GIB) might be expected to invest for longer and larger amounts, but requires projects to be investment grade. The energy market is sub investment grade so unless underwritten, the GIB (and other commercial institutions) will not invest because of commodity risk.

### Fossil Fuel indexation

- Global fossil fuel price risk is a key concern in two ways - general changes in fossil fuel prices, and changes in efficiency of fossil fuel use in the plant due to the CCS component. Without fossil fuel price indexation, the generator is exposed to both these risks. Some indexation of fossil fuel is essential for CCS.
- Adjustments only when there is a permanent shift in fossil fuel price will not be sufficient. The ability to adjust for short term fossil fuel price changes is also required.
- A potential approach would be to split the risks with indexation covering the risk of actual fossil fuel prices while the generator takes on the risk of changes in fossil fuel use efficiency.

### Emission Performance Standard (EPS)

- Most projects are commissioned in stages and it is important to run and test the coal fired generation plant unabated and free from the EPS. Banks would consider how long an unabated plant is able to run for and therefore how much risk is associated with the cash flow given potential lower operating hours. Inability to run unabated before the CCS component is completed would have a negative effect on credit committee decisions regarding signing off projects.

### CCS compared to other low carbon technologies

- The Government has clear targets for renewables generation (15% by 2020) but there are no targets for CCS. There is also currently much more detail on how the CfD would work for renewables compared to CCS.
- Compared to other low carbon technologies most investors are less engaged in deep analysis of how CCS will work under changes proposed by the EMR. Investors are still waiting for further details and clarification.
- The amount available for CCS from the Levy Control Framework once allocations for other technologies have been made still remains an issue.



## Appendix 2

### Response to: Consultation on the draft Electricity Market Reform Delivery Plan Published July 17th 2013

#### Submitted 25th September 2013 Background

This response to DECC's Consultation on the draft Electricity Market Reform Delivery Plan is informed by discussions with the UK CCS Commercial Development Group.

The CCS Commercial Development Group is one of three national leadership groups established following recommendations by the CCS Cost Reduction Taskforce. The taskforce was commissioned by DECC in 2012 and delivered its final report to the Energy Minister in May 2013. The CCS Commercial Development Group recognises the role CCS has in abating carbon dioxide emissions and aims to secure ways, together with the UK Government, of making UK CCS projects bankable, and reducing the cost of capital of CCS projects. The CCS Commercial Development Group brings together a range of key CCS stakeholders including potential financiers, insurers and project developers. It is led by the ERF with the support of the ETI.

While DECC's Consultation does not focus on CCS, we believe that it is essential that the unique characteristics of CCS are given full consideration to avoid the generic framework being developed for renewable energy technologies under EMR becoming a barrier to CCS investment. Barriers to deploying CCS at scale may negatively impact the EMR aim of supporting investment in all low carbon technologies at least cost to consumers.

The CCS Commercial Development Group is committed to continue supporting DECC to successfully deliver EMR and would welcome the opportunity to further discuss and provide input to this issue as the Government engages with CCS stakeholders in developing CCS specific EMR details. We have set out some CCS specific issues that we believe need to be considered when developing the general EMR framework.

#### Allocation of CfD and eligibility for CfD

- An approach to CfD allocation that gives clear signals to the market that the UK is committed to CCS as part of its low carbon future is needed to give confidence in a CCS industry. Providing a clearer signal on the market for CCS will increase confidence among investors, leading to greater interest and investment in CCS.
- There needs to be clarity on how CfDs are allocated for CCS in relation to other technologies including nuclear. Allocation according to technology with a minimum level of allocation for CCS would help provide confidence that the Government is committed to developing a CCS industry.
- The need for application eligibility criteria to prevent bed blocking and ensure only viable projects are awarded CfDs is important for CCS project developers and the criteria need to be suitable for CCS projects. The requirements of planning permission and a Grid Connection Offer as currently described are unsuitable for CCS projects due to the scale and lead times involved. CCS Front End Engineering Design (FEED) costs are a very significant investment in their own right amounting to several £10s of millions. As such, for CCS project developers to make the large investments needed for FEED, developers would need at least an "amber light" (a meaningful form of commitment) to know that the CfDs have been earmarked for the project.
- The CCS Cost Reduction Task Force report (May 2013) showed that starting to invest in the learning curve, could lead to CCS being cost competitive with other low carbon technologies in the UK, whilst retaining the reliability of fossil fuel generated electricity. Multiple CCS projects would enable cost reductions from transport and storage infrastructure, improved engineering and supply chain and improved financing. Without clarity on the CfD allocation process,

## Appendix 2 continued

### Strike Price

multiple CCS projects making use of shared infrastructure are unlikely to be achieved.

- Strategic allocation of CfD resources to projects which offer greatest potential to the development of a cost competitive CCS sector is needed to contribute to a lower cost electricity sector.
- CCS is a technology with variable applications e.g. it can be used on gas or coal, baseload and flexible energy, and to decarbonise new and existing plants. Each of these CCS market segments are likely to have a different cost and would require a different Strike Price.
- The assumption that Strike Prices will reduce may not be true for successive CCS projects. The required Strike Price will be influenced by the transport and storage infrastructure required. The need for new transport and storage infrastructure, which may be important in establishing new CCS clusters, may lead to a higher Strike Price requirement due to the added costs for establishing transport and storage infrastructure. While these kinds of considerations may be some way into the future, it would be useful for the government to signal at this stage that it understands these CCS-specific considerations.
- The exact efficiency of a gas or coal plant with CCS will only be known for certain after commissioning. As such, it needs to be clear that the Strike Price can be adjusted. This will give early investors confidence that they will be able to achieve an appropriate rate of return on the substantial investments they will be expected to make in early CCS projects. This principle should be extended to other early CCS projects, beyond the DECC commercialisation programme.

### Availability of Finance

- Project developers will need clarity and comfort around the Strike Price and arrangements around rebasing, as well as the potential CfD allocation mentioned above before they are able to commit the large investments required to develop the project.
- Capital providers believe that the broad CfD structure will be the same for all technologies. It is the details of how the Reference Price and Strike Price are set that will determine if CCS projects are viewed as investible. There is likely to be too much variation in cost and risk structures in initial CCS projects for full standardisation of terms. As such, setting of the Strike Price will need to be made on a project by project basis for the foreseeable future until the sector achieves some maturity.
- Financing will only be available for the length of the CfD revenue stream. The large investment needed for CCS may require the involvement of capital markets (bonds, pension funds, Export Credit Agencies etc). These tend to work on longer times scales e.g. 20 years and the proposed CfD contract length of 15 years will not enable long-term funding to be obtained from these sources. Additionally a short term CfD (15 years or less) is also unlikely to enable the rating agencies to rate a project as investment grade, effectively shutting off the public bond market.

### Fossil Fuel Indexation

- CCS is fundamentally different from renewables and nuclear. It has the advantages of reliability of fossil fuels, but it is also subject to the price variation of coal and gas.
- As global fossil fuel price risk is a key concern, some indexation of fossil fuel prices is essential for CCS.
- Without fuel price indexation CCS projects may not be viewed as investible projects.

## Appendix 2 continued

### Power Purchase Agreements

- Generators will need to enter into Power Purchase Agreements (PPAs) with a third party in order to sell their power. The Purchase Price of the PPAs will be expected to be at a discount to the Reference Price. The generator will then receive the difference between the Reference Price and Strike Price, not the Purchase Price and Strike Price, and so will earn less than the Strike Price.
- Recent experience shows that obtaining bankable PPAs from the market has become very difficult. The Energy Bill contains the proposal for a “Backstop PPA” in the event that the generator is unable to obtain a suitable PPA from the market. The Purchase Price for these is intended to be set at a level which should enable the generator to meet its debt services obligations but will not provide any return on equity. This is to allow projects to raise debt on the back of the Backstop PPA and then enter into short term PPAs with third parties at a Purchase Price which would provide an equity return. This means that if commercial PPAs are not available then a utility group would be forced to enter into a Backstop PPA with the generator. This raises the following issues:
  - There is no incentive for a utility to offer a PPA at a price which is higher than the Backstop PPA price if it knows that it will be forced to enter into a Backstop PPA at a lower price.
  - Lack of clarity on what happens to the supply obligation of the generator under the Backstop PPA in the event that it enters into a commercial PPA and therefore sells power to that third party. This leaves the Backstop PPA provider exposed to not knowing whether it will be required to purchase the power under the Backstop PPA.

### Follow on projects

- Reduced incentive for equity investment. As the Backstop PPA will be used to size debt facilities, equity is exposed to additional risk in terms of securing a return on investment which is uncertain, and therefore likely need to be higher than it would otherwise have been to reflect the additional risk.
- Additionally, CCS may have other requirements as it has different characteristics to intermittent renewables energy generation projects.
- Terms for the first projects will need to be worked out for each CCS project according to its specific characteristics, with a view to its particular risk properties and its value in developing the broader CCS sector.
- There are currently two projects in the CCS Commercialisation Competition and at least a further three projects that are at an advanced stage with some under the FID-enabling programme. Final Investment Decision (FID) enabling projects and other advanced projects are developing on a similar time frame as the Competition projects and so should be treated similar to the Competition Projects.
- Early CCS projects will contribute towards creating a CCS industry which is likely to be essential if the UK is to decarbonise its electricity sector at least cost, so it is essential that early follow on projects outside of the Competition go ahead.
- As above, some of the special measures for the Competition projects such as the ability to rebase the Strike Price at set points, will need to persist beyond the Competition. This is necessary as some of the commercial and technical risks will persist in the early years of EMR before CCS projects can be supported solely on standardised CfD contracts.

## Appendix 2 continued

### Flexibility of key framework elements

- Unlike some renewable technologies that have received very large funding support over several decades, CCS is at an early stage of demonstration. CCS also has various complex and integrated technologies, and has various applications in the energy market. Each of these types of CCS projects will have its own cost and risk profiles. Additionally, CCS project development has a much larger cost and timescale than most established renewables technologies, and may require third parties for storage and transport infrastructure. Given the important differences between renewables and CCS, enough flexibility to meet the special requirements of CCS needs to be ensured in key elements of the CfD framework such as the Eligibility Criteria, Target Commissioning Window, Long Stop Date, and Milestones evidencing substantive financial commitment.

### Policy signals

- CCS is often compared to renewables in EMR discussions, though a comparison with nuclear is viewed as more appropriate. Like nuclear, CCS is also a complex technology with high capital costs though it has the potential for much greater flexibility.
- DECC's CCS policy goal of developing a CCS industry, and not just successful Competition projects needs to be clearer. An updated CCS Roadmap that showed how the CCS Competition projects and early follow on projects can lead to an enduring CCS regime would send a strong positive signal to the market.
- The enduring regime projects are too far in the future to contemplate though it is essential that any legislation has the flexibility to accommodate the enduring CCS regime.

- We note that the level of ambition for CCS suggested in the scenarios published in the draft Delivery Plan is comparatively low compared to scenarios produced by the ETI or the Committee on Climate Change in its advice on the next steps in EMR. For example, the ETI's latest energy system modelling deploys around 14 GW of CCS capacity in the electricity sector (as well as significant applications beyond the electricity sector). The low levels of CCS deployment in most of the scenarios in the draft Delivery Plan will not give the market a sense of direction and commitment to CCS. This and the slow progress in CCS policy and the Competition is leading to a loss of credibility. Some project developers and financiers are questioning the commitment of DECC to a CCS industry.

## Appendix 3

### Ecofin Research Foundation and Energy Technology Institutes' response to DECC's request for feedback

**Submitted:  
31st October  
2013**

This response to DECC's request for feedback is specific to CCS issues and is informed by discussions with the UK CCS Commercial Development Group. It follows a response to DECC's Consultation on the draft Electricity Market Reform Delivery Plan submitted on 25th September 2013.

#### Introduction

The CCS Commercial Development Group is one of three national leadership groups established following recommendation by the CCS Cost Reduction Task Force. The task force was commissioned by DECC in 2012 and delivered its final report to the Energy Minister in May 2013. The CCS Commercial Development Group recognises the role CCS has in abating carbon dioxide emissions and aims to secure ways, together with the UK Government, of making UK CCS projects bankable, and reducing the cost of capital of CCS projects. The CCS Commercial Development Group brings together a range of key CCS stakeholders including potential financiers, insurers and project developers. It is led by the Ecofin Research Foundation with the support of the Energy Technologies Institute (ETI).

#### Key issues relevant to the allocation of EMR support to CCS projects

The following section is intended to set the context to inform DECC's thinking on the approach to allocating contracts for difference to CCS projects.

- **CCS is uniquely valuable and flexible:** ETI's modelling of the UK energy system robustly shows that a sizeable CCS sector is central to an efficient least-cost approach to meeting carbon targets. Failure to deploy CCS would increase the annual costs of meeting carbon targets by tens of billions of pounds. The value of CCS is evidenced by ETI 2050 pathway analysis that indicate that without CCS, the next least-cost pathway is 1% GDP more expensive. This points to a strong case for ensuring that a significant share of EMR resources is allocated to support the development of an efficient CCS sector.

- **CCS is crucial beyond (as well as within) the electricity sector:** among the technologies eligible for support through EMR, CCS is uniquely flexible and widely applicable. It can deliver baseload and flexible low carbon electricity, but it can also play a critical role in enabling low cost decarbonisation of the broader UK energy system. Wider applications of CCS include industrial CCS, enabling other flexible low carbon fuels such as hydrogen through gasification applications, or delivering highly valuable 'negative emissions' when combined with bioenergy.

- **Support for CCS electricity projects is vital to broader development of CCS:** EMR support for low carbon electricity projects is vitally important in supporting development of early CCS projects. Low and volatile carbon prices make CCS commercially unviable in trade-exposed industrial or gasification applications. However, as early CCS projects will be based around the power sector, these projects represent a pathway towards wider application of CCS in industry and other forms of energy (e.g. gasification).

- **A UK CCS sector requires strategic development, not a collection of atomised projects:** A fully developed CCS sector will rely on an integrated CO<sub>2</sub> transport and storage network and will be made of a variety of applications and technologies, many with linkages beyond the electricity sector (e.g. EOR, gasification, chemical production, industrial decarbonisation). Work by both the UK CCS Cost Reduction Task Force and by the ETI clearly points to the potential for delivering value and economies of scale through developing networks. The development of the sector is likely to be highly path-dependent and geographic in character, which will shape subsequent opportunities to develop clusters, infrastructure and storage resources.

## Appendix 3 Continued

### Conclusions

- **Simple price comparisons are the wrong metric for allocation of EMR support:** EMR resources are scarce and should be allocated to deliver the greatest impact on broader UK decarbonisation (rather than just electricity sector decarbonisation). Each early CCS project is likely to have different characteristics, for example in terms of the capture technology they develop, the development of infrastructure, how they contribute to the development of clusters, whether they open up opportunities for subsequent projects or for applications in other sectors. Therefore, each early CCS project is likely to have a specific strategic contribution to make to building capacity for CCS to enable broader decarbonisation. Equally, each project is likely to have specific risk characteristics. Simple price comparisons (£/MWh) are unlikely to be a reliable guide to value for money in allocating EMR support resources for some time to come.
- **Allocate sufficient Levy Control Framework to develop CCS:** EMR will be the key source of support to enable the CCS sector to develop to maturity. Given the high value that CCS can deliver to UK decarbonisation there is a strong case for ensuring that a significant portion of LCF resources are allocated to developing CCS within and outside the CCS Commercialisation Programme. In practice this would mean supporting the construction of at least four full-scale projects by 2020. This level and pace of deployment will ensure CCS moves quickly towards realising the vision set out in the CCS cost reduction task force report.
- **Adopt a strategic approach to allocating resources between projects:** Given the heterogeneity of CCS projects and applications, along with the likely inter-dependencies between early projects, simple price comparisons will not be a reliable guide to value for money. A more strategic approach should be

adopted, for example by using a set of criteria that take account of broader strategic considerations and their value in evaluating early projects following the CCS Commercialisation Programme projects.

- **Take account of particular characteristics of CCS projects in contract design:** CCS projects will have varied risk characteristics and are likely to be different in terms of scale and their inter-dependency. This needs to be taken into account in the design of contracts and processes for allocating support. A range of issues has been raised by the CCS Commercial Development Group. In practice an open and engaged approach should be taken to resolving these issues, rather than attempting to design an enduring template at this early stage.
- **Certainty is needed urgently:** The need for clarity on availability of CfDs for early CCS projects outside of the CCS Commercialisation Programme currently being developed is urgent. There is a real risk that private sector investors will not be able to sustain the required development expenditure to keep these projects alive and result in cancellation of projects. This could set back wider scale development of CCS in the UK by many years.
- Further details on the challenges to mobilising private sector financing for CCS and on the significance and value of CCS in the UK can be found at:

[www.eti.co.uk](http://www.eti.co.uk)

[www.ecofinfoundation.org](http://www.ecofinfoundation.org)

### Further information

## Appendix 3 Continued

### Response to questions

#### Question 1

##### General allocation issues

1. The Allocation Methodology sets out a system of eligibility checks, milestones and target commissioning windows and longstop dates that are intended to provide developers with certainty of CfD award at earlier stage while ensuring that successful applicants are those with a strong chance of progressing to commissioning. Is the proposed system suitable for nuclear and CCS projects?

- An Allocation Methodology that provides developers with certainty of a CfD award at an earlier stage and ensures that only applicants with a strong chance of progressing to commission is welcomed by the Commercial Development Group. However, the suitability of the methodology for CCS is very reliant on the specifics of the measures put in place. The measures should not introduce additional risk to developing or financing the project.
- The currently proposed eligibility checks, milestones and target commissioning windows and longstop dates introduce additional risk to projects which could lead to a higher Strike Price being required and result in a reduction in value for money.
- The timescales and costs faced by CCS projects are not directly comparable to renewable projects. CCS projects will likely need to spend multiple tens of millions of pounds of pre-investment in detailed FEED studies before clarity on the potential Strike Price required can be achieved. This FEED process can take approximately 18 months.

### Appendix 3 Continued

- Given the scale of pre-investment required, CCS projects would require a high degree of certainty that there will be sufficient budget for the project to be awarded a CfD subject to the value for money criteria being met. A 'pre-allocation' that ring-fences a portion of the CfD budget for the project will provide developers with the confidence required to self-fund the early project development work. Developers are unlikely to commit the high level of resources for early development work if there is significant risk that the CfD budget might be exhausted.
- Private sector financiers are likely to require very high confidence that a project will be awarded a CfD for them to invest through for example, a contract with conditions attached.
- Given the time scale of CCS projects, pre-allocation would need to be made several years before Final Investment Decision (FID) of a project, and at a time when final design and cost of the project will still be uncertain. A range for the acceptable Strike Price that meet the Government's value for money requirement and economic viability of the project will need to be agreed with the developer.

#### Question 2

2. Would the proposed eligibility criteria work for nuclear or CCS? What additional eligibility checks might be needed?

- Eligibility criteria that prevents bed-blocking of CfDs and that ensures only viable projects are awarded CfD contracts are welcomed.

## Appendix 3 Continued

### Question 3

- The currently proposed criteria of planning permission and grid connection offer for generic CfDs are unsuitable for CCS projects as both criteria would require significant financial commitment by developers before they have confidence in the availability of CfDs for the project.
- A “pre-allocation” stage in the Allocation Methodology could provide developers with the confidence to commit the substantial pre-investment needed and demonstrate its ability to meet a stringent eligibility criteria at the time when the CfDs are confirmed by the Government.
- In addition to meeting design and engineering criteria, eligibility checks should also consider financial credibility of the projects.
- Given the significant investment required for CCS FEED, the spending of funds on FEED would be a suitable eligibility criteria.

3. What might demonstrate suitable evidence of financial commitment for nuclear and CCS projects? How does DECC/CfD Counterparty ensure developers make progress towards getting the necessary approvals (and eventually commission)?

- CCS requires long time scales. Without a “pre-allocation” stage during which FEED can be undertaken, it is not feasible for CCS project developers to demonstrate financial commitment through a FID within a year of signing a CfD contract. A “pre-allocation” could make it possible for FID as evidence of financial commitment.

### Question 4

- Significant resources are required for CCS FEED and pre-FID stages. Once the developer has committed the pre-investment and taken FID, they have a strong interest to ensure the project is able to generate the contracted capacity as soon as possible. As CCS projects are large, significant delays ahead of commissioning will be obvious.

4. What variations to target commissioning windows and longstop dates might be needed for nuclear/CCS?

- As CCS projects are large and complex and there is limited experience in building CCS plants, there is significant uncertainty around development and construction times. It is important that if target commissioning windows and longstop dates are imposed, they reflect fully the longer timescales of CCS.
- It is also essential that these measures do not penalise developers for risks outside of their control. Appropriate force majeure provisions need to be in place for the project to be completed with manageable penalties.
- Unsuitable target commissioning windows and longstop dates introduce significant risk, which will increase the price of CCS projects. The addition of these risks could potentially mean CCS projects are viewed as uninvestible by financiers.
- The large sunk costs in design, development and construction of CCS are in themselves a major incentive for developers to commission the project in a timely manner.



## Appendix 3 Continued

### Question 5

5. Is the proposed structure for adjustments to capacity appropriate or necessary for nuclear / CCS?

- Clarity is required on whether capacity refers to installed capacity or operational capacity. Installed capacity of CCS plants is not expected to change once a CfD contract is signed post-FEED. Consequently the 5% adjustment of the installed capacity at the milestone date and at the longstop date do not impact CCS.
- If capacity refers to operating capacity, the requirement to reach 95% capacity before CfD payments are made is unsuitable and adds additional risks to CCS projects. It can take a significant time for fossil fuel plants to fully commission and operate at design capacity. Due to the complex nature of CCS plants this is a bigger issue.

### Question 6

6. How might the system of eligibility, milestones, target commissioning windows and longstop dates need to vary under a competitive allocation process?

- This question is irrelevant for CCS at this stage. The CCS sector is not sufficiently mature for competitive allocation such as auctions. For example there is currently no CCS transport and storage infrastructure and no established norms for the commercial arrangements that might exist across the chain. Hence, projects need to be considered on a case by case basis with bilateral negotiations.

### Question 7

7. What are the barriers to further improvements in underlying competitive conditions for nuclear and CCS? What steps can industry and Government take to resolve these barriers?

- Lack of confidence in a CCS industry – there is a general lack of confidence that the government is committed to promoting a CCS industry. Confidence can be increased with a clear statement from the government on CCS deployment and clarity that CfDs will be made available for CCS. A clear signal for an enduring CCS industry would increase confidence among developers and financiers, lead to greater interest and investment in CCS and stimulate greater competition.
- Risk sharing – it has been previously suggested that CCS projects outside the CCS Commercialisation Programme would be required to take full technical and non-technical risks. Competition could be promoted if it is acknowledged that early follow-on projects will still face significant uncertainties and will require some of the special terms in the Commercialisation Programme to be maintained. Also early follow-on projects would require bilateral negotiations and bespoke CfD contracts. A failure of early follow-on projects being commissioned will likely lead to a significant delay in development or stalling of a CCS industry in the UK.

## Appendix 3 Continued

### Question 8

8. What options for competitive allocation should Government be considering?

- CCS is a technology that is not mature enough for competitive allocation. Additionally, given the range of potential CCS projects, CCS projects cannot be directly compared to each another.
- In the near to medium term tenders with bilateral negotiations are the best method to take CCS projects forward as it allows CCS projects to be evaluated based on other strategic criteria (addressed in question 10) that contribute to a cheaper and low carbon energy sector along with cost of the specific project.
- Auctions will not be an appropriate allocation mechanism for CCS in the near to medium term. Due to the unpredictability of auctions, developers are unlikely to commit the significant resources required for initial stages of a project ahead of the auction. An auction approach will also not enable the other strategic criteria to be considered fully.

### Question 9

9. Does the structure of evaluation and price-setting of the “constrained allocation” process in the Allocation Methodology work for nuclear and CCS?

- Due to the significant upfront cost required for CCS projects, a constrained allocation approach will not be suitable for CCS.
- Constrained allocation creates uncertainty around the CfD available and does not incentivise developers to invest the significant pre-investment required to get CCS projects to the point of application.

### Question 10

• The constrained allocation approach poses a risk to the Government as the discouragement of investing necessary pre-investment could lead to projects being over optimistic and result in them not being delivered at the time/cost expected.

10. Are there criteria other than price that are important in selecting nuclear and CCS projects? If so, which? How can these criteria be assessed? How can delivery against these criteria be monitored?

- Market segment – CCS is variable and can be used for base-load or flexible energy. The role a project fulfils in balancing the wider energy system should be considered.
- Fuel source – CCS can be applied to both gas and coal. The diversity a project adds to the energy system needs to be considered.
- Clusters – CCS projects that contribute to development of shared and integrated transport and storage infrastructure that can be utilised by future CCS projects could appear more expensive in the near term but lead to significant cost savings in the long term. Factors such as oversizing of infrastructure and distance to storage sites/hubs needs to be considered.
- Other industries – unlike renewables, power stations with CCS could provide infrastructure that enable high CO2 emitting industrial sectors to employ CCS thereby helping the UK further reduce its emissions.

## Appendix 3 Continued

### Question 11

11. Does the position in the Allocation Methodology on adjustments to the Strike Price reflect an efficient balance of risks, given the specifics of nuclear and CCS projects?

- CCS projects are very unlikely to alter their planned capacity. This means Strike Price adjustment due to installed capacity being lower than contracted is irrelevant for CCS. It should be noted that as with other fossil fuel plants, it could take some time for full operating capacity to be reached in a CCS plant.
- There is some uncertainty around the efficiency losses in CCS plants. Efficiency will have an inversely proportional relationship with Strike Price requirements i.e. a less efficient plant would require a higher Strike Price.
- It is important that any Strike Price management does not lead to uncertainty in the value of CfDs as this leads to additional risks to developers and financiers.

### Question 12

12. Can contract terms for nuclear or CCS projects be largely fixed ahead of launching the allocation process?

- Owing to the fact that CCS is a maturing technology, and that CCS projects are diverse, there are limited terms that can be fixed ahead of the allocation process. A “one size fits all” approach is unsuitable for CCS at this stage.
- CCS projects will have different risks and costs due to its variable applications (gas/coal, baseload/flexible) and differences in availability of transport and storage infrastructure. In the near to medium term CfD contracts for CCS will need to be bespoke and result from bilateral negotiations.

- Contract terms such as force majeure will need to be flexible to evolve as the CCS industry moves from the current phase to an enduring regime.
- CCS is still undergoing its cost discovery process (capex and opex) so a fixed Strike Price will be difficult to set. It is suggested that, if prices are set pre-FEED, a range is used and that the final price is negotiated within the range on FEED completion.
- Terms that could potentially be standardised include CfD length, reference price, metering arrangements, change in law and indexation of Strike Price to global fossil fuel. Due to the reliance of CCS on global fossil fuel prices, it is essential that the Strike Price includes fossil fuel indexation as failure to do so may lead to CCS projects being viewed as uninvestible.

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