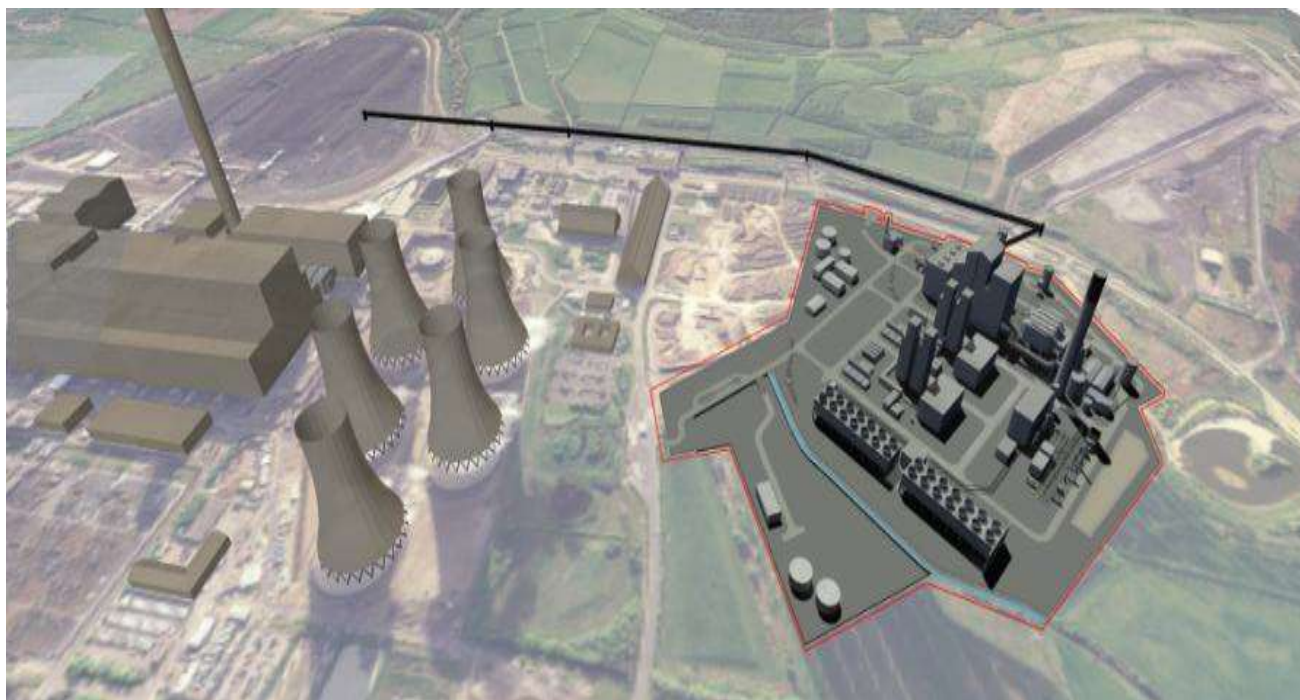


TARGETED REPORT: FINANCING LARGE SCALE INTEGRATED CCS DEMONSTRATION PROJECTS

MAY 2014



Prepared by:



S U P P O R T E D B Y



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Executive Summary

In many respects, this report is a “good news – bad news” story. The good news is that awareness of, and willingness to consider financing CCS projects has significantly improved since 2010. The bad news is that the perception of CCS remains one of a nascent industry with some pessimism/scepticism regarding the timeframes expected for the commercial availability of the technology. This is a simplistic assessment of a significantly more complex picture that emerged during this study, both in terms of what CCS actually is and what will be required to raise commercial financing for the industry.

CCS means many things to many people. The current range of technology options, applications and business models mean that it is difficult to talk generically about the industry. The report also highlights very marked regional differences in the nature of CCS projects as illustrated in the following graphic from the Global CCS Institute's 2013 global status report below.

Diagram 1 – Large Scale Integrated Projects (LSIP) Proceeding to Operate & Execute



Source: Global CCS Institute – The Global Status of CCS 2013

As illustrated, in North America CCS is predominantly focused on gas processing and other industrial applications (75%) with the captured CO₂ being used almost exclusively for enhanced oil recovery (EOR). By contrast, the most advanced projects in Europe have no EOR component and a higher proportion of power generation related projects. We believe that this serves to explain the predominance of operating projects in North America, where the rationale for the project is much more based around the economics of the underlying industry and revenues earned from the products produced rather than CO₂ extraction. In contrast, the European projects are more driven by CO₂ reduction targets and absent EOR and other product revenues, rely heavily on subsidy to underpin the economics.

In terms of financing for CCS, despite an increasing number of operating plants, there have been no examples of commercially (bank) financed CCS projects yet as far as we are aware, so our focus has been on what financing sources would be available for CCS and what would it take to access this financing. In terms of financing sources, it is clear that there is substantial potential liquidity for CCS if projects are structured correctly to access this liquidity. The following sources are expected to play a key role in the financing of the CCS industry:

- **Export Credit Agencies (ECAs):** Significant support could be available in the form of guarantees and potentially, direct funding for CCS projects. Key to accessing this support is the sourcing of equipment and other services from countries with the best available ECA support but this can also

be accessed via selection of equity partners so in structuring the project, both strategic partnerships and procurement needs to be a key consideration.

- **Multilaterals:** As has been demonstrated in other sectors, multilaterals can be a source of substantial funding for projects in relatively new sectors. In Europe for example, the European Investment Bank (EIB) has played a key role in the development of the off-shore wind sector by committing large amounts of debt to the sector to support EUR1bn+ financing packages for development projects. Whilst these institutions have geographical limitations, most appear to be keen to support CCS development.
- **Commercial Banks:** There is a very deep global debt market for energy and energy related projects and many of the key players in this market are increasingly focused on clean energy. In 2013, approximately US\$120bn was raised in project finance for energy related projects (excl O&G) but it remains to be seen whether CCS can access this market.
- **Other Sources:** Energy infrastructure projects have also traditionally been able to access capital markets in Europe, Asia and the Americas. However, this is generally for regulated type projects with a well understood risk profile and frequently an investment grade rating. CCS does not yet fall into this category in our view, although various forms of credit enhancement schemes may be able to sufficiently transform the risk to tap this market in some cases.

Considering the substantial liquidity available to energy projects in general, the key question then becomes - can CCS projects tap this for commercial financing and how do they go about it? Despite the depth and proficiency of the debt markets, our analysis suggests that the complexity and current risk profile of CCS will initially be a limiting factor for commercial financing so early engagement with all potential sources of finance is essential, and structuring at all levels will be crucial to the final financing success.

Looking in more depth, based on the research undertaken for this study, currently by far the most significant barriers to accessing commercial financing are the interrelated issues of technology, integration and viability with frequent reference to:

- “White Elephant Risk” – what if it doesn’t work?
- Performance – what if it doesn’t work as well as expected?
- Cost – what if capital and/or operating costs are more than expected?
- Government or public support¹ – how much and is it sustainable?

These concerns are not uncommon for new industries, although for technology the issue with CCS is often more related to the application of existing technology on a larger scale and in integrated projects. However, in current financial markets, debt liquidity is often inversely proportional to risk and there is a point at which there is no price at which institutions will bank a risk. The challenge for CCS projects is to structure an acceptable risk profile for financing by allocating risks to those best able to take the risk, whether this be sponsors, insurers, financiers or ultimately in some cases, government for early projects in some jurisdictions. ***The project finance community are expert at assessing and pricing risk and whilst we believe they will be prepared to accept some CCS risk, on early projects their view will inevitably be conservative.***

This view was reflected by many of the commercial lenders, multilaterals and development finance institutions (DFIs) contributing to this report. Until mid-2012 many of these institutions had not been focused on CCS, considering it to be at the demonstration or pilot stage rather than “finance ready”. Whilst a significant number have dedicated more resources recently and can now see the global business potential in an industry closely related to their core business, most have not yet really focused on the detail of the industry due to the lack of tangible opportunities and so have not fully assessed the risks involved. With this in mind, when discussing risk allocation and structures with these institutions, the above key risks were a recurring theme as was the need for extensive and consistent financial, policy and regulatory support from Government.

There is also no doubt that at a high level, financial institutions would prefer to focus on projects that are fundamentally economic with no subsidy or as little subsidy as possible. In the absence of this, one crucial precursor to raising commercial finance for the CCS sector will be the confidence in

¹ Support in the broadest sense required to compensate for the cost differential attributable to incorporation of CCS irrespective of the sector in which it’s deployed. Support could be in the form of upfront capital grant, tax breaks or ongoing support through feed in tariffs for example, and from government or the consumer

long-term policy and the sanctity/enduring nature of the underlying regulatory and financial support for the industry. However, there are precedents for large scale financing of heavily subsidised sectors of the energy business, and we can draw comparisons to the off-shore wind sector in Europe as an analogous industry, having faced similar cost and technology challenges to those of CCS. The positive message on which to conclude is that despite the relatively recent engagement of financial institutions with CCS, there is an enthusiasm to look at the financing of projects. This has been further enhanced by:

- The emergence of tangible projects on which to start commercial debt structuring discussions, notably in the US, where the Texas Clean Energy Project (TCEP) is expected to agreeing a financing deal with Chinese parties and the Lake Charles Clean Energy project in Louisiana;
- The resulting development of a template for CCS projects with tangible revenue streams on which to base a financing rather than projects wholly reliant on subsidy for economic viability; and
- Developments in policy and regulation which appear to have begun to create an environment where large scale CCS projects could be successfully implemented. The new UK Contract for Difference (CfD) feed in tariff mechanism is probably the best example of this and two CCS projects have been selected to negotiate bespoke contract structures that could form the template of a larger CCS industry with commercial debt finance.

We believe that there is good cause for optimism that CCS projects will be able to access commercial debt financing if they are executed in a supportive environment, if all stake holders are pragmatic in structuring the projects; and with innovative use of all available sources of financial support. Success with early projects should enable risk, commercial and financing precedents to be established to increase availability of finance as the installed capacity grow. This in turn has the potential to lead to significant improvement in financing terms over a relatively short period of time.

One question often asked is “why bother with debt at this stage?” Our response to this is that the scale of ambition of CCS and the associated capital investment is such, that equity alone will not be sufficient to build out the industry. Debt is therefore essential rather than optional so it is important, in our view, to establish bankable risk and contractual structures as early as possible so that debt does not become the constraining factor in the development of CCS.

1. Introduction

It is clear that the Global Financial Crisis (GFC) and knock-on effects on the financial markets have created a difficult environment for the financing of large-scale infrastructure projects. Whilst financing is still available and conditions are improving, financial institutions have become increasingly focused on the technical, economic and commercial fundamentals of the projects being financed. Against this background, there are now a number of Carbon Capture & Storage/Sequestration (CCS) projects around the world moving towards the execution phase and likely to be seeking external financing as a key part of their funding plan. The financing challenge facing these projects not only relates to the challenges of the financial markets, but is compounded, in many cases, by the “first of a kind” (“FOAK”) nature of the early CCS development projects and associated non-standard risks (technology/scale up/integration) of the industry.

CCS investors and authorities, therefore, need to be very cognisant of the requirements of the financial institutions (in the broadest sense) whilst structuring the regulatory and commercial terms of the early projects in order to be able to access the debt required to finance the projects under development, and the industry as a whole in the longer term.

Societe Generale has prepared this report based on an extensive survey of financial institutions in key CCS markets as described below. This is supplemented by our involvement over several years with a number of active CCS demonstration projects around the world, our independent analysis of financing options for CCS, and also on our extensive experience of advising on and financing major infrastructure projects. Based on this analysis, this report looks at among other things:

- The perception of CCS in the financial community;
- Structuring considerations to optimise the availability of finance;
- The potential roles and requirements of various financing sources, including commercial banks, Export Credit Agencies (ECAs), Public Finance Institutions (PFIs) and “green banks”;
- Likely appetite and capacity of identified financing sources now and in the future; and
- The impact of funding source on debt terms including structure, tenor, covenants and pricing.

We conclude by using three projects currently in development to illustrate, based on publically available information, how the findings of the work for this report could impact on the financing for the early CCS projects.

2. Methodology

In addition to using the experience base of Societe Generale, we have undertaken significant research and market sounding of a wide range of potential sources of finance available to early stage CCS projects, to assess current and future funding options in various markets where CCS is being considered. We have deliberately not based this research and market sounding on specific projects, nor have we differentiated between specific types of technology, as many of the significant considerations are more generic in nature.

In preparing this report we have sought to:

- Conduct a comprehensive review of existing published materials;
- Assess work undertaken on previous projects around risk assessment and key financing issues to the extent this is in the public domain;
- Engage with a group of leading financial institutions with a focus specifically on leading commercial/project finance banks, ECAs, PFIs and green / policy banks, which we consider to be key potential sources of finance for CCS; and
- Identify other potential funding sources and stakeholders with relevance to the financing of CCS.

In terms of engagement, we have contacted a wide variety of institutions that could potentially support the financing of early CCS projects:

- The major ECAs based in Europe, Asia and the Americas to reflect the likely sourcing of equipment for CCS development around the world;

- Approximately twenty financial institutions, based in Europe, Americas and Australasia, which represent the majority of the project finance facilities closed globally in recent years. These institutions included regional as well as global players to facilitate evaluation of any regional trends in support for CCS; and
- Eight major multi-laterals, “green banks” and other PFIs based on their ability to provide finance or other support in countries where CCS is being developed.

Based on the information gathered we have then assessed the extent to which finance would be available for early CCS projects, the likely terms of this finance, prerequisites for making debt available and any potential material constraints on CCS funding.

We conclude the work by drawing together all aspects of the study to offer a view on the high-level risk allocation and appropriate financing plans for various stages of the development of the CCS industry.

3. The Respective Roles of Institutions in Supporting CCS

3.1 Available Financing Sources

There is a long track record of raising finance for multi-billion dollar energy and infrastructure projects around the world. In general, this financing has fallen into several generic categories:

- **Commercial Debt:** Typically medium to long-term amortising loans, secured on the assets being financed with limited, or no, recourse to the shareholders of the project;
- **ECAs:** providers of political/commercial risk insurance, and potentially direct lending to support the export of equipment and services from the country in which the ECA is based;
- **PFIs/Multi-laterals:** institutions funded by one or a number of governments to provide finance and/or guarantees in defined countries and for specified sectors in support of policy objectives; and
- **“Green Banks”:** Institutions focused specifically on supporting the development of clean energy projects, usually based on policy objectives.

Other potential funding sources to also be considered include:

- **Debt Capital Markets:** Long term financing provided by private/institutional investors through the issue of bonds, usually post construction, and for investment grade or non investment grade risk
- **Credit Enhanced Structures:** Various schemes are available to enhance the underlying credit of a transaction to facilitate debt or capital market financing.
- **Investment Funds:** A number of specialist funds have been established to provide development or “mezzanine” funding to projects in the clean energy sector.

The availability and applicability of each of these potential funding sources depends on a wide variety of criteria including not least, geographical and risk considerations, although in many cases we see financing plans that integrate two or more of the above to achieve optimal financing terms.

We focus later in this report on the funding requirements of each of the above categories of institutions as well as the differences in approach between specific institutions where this is applicable. However, in general terms the role each could play in financing CCS projects is summarised in the following table:

Table 1 – Financial Institutions and Their Role

Institution	Role	Advantages	Disadvantages	Comment
Commercial Banks	Term debt providers	Flexibility Deep market liquidity Sector experience	Extensive due diligence Heavy documentation Execution uncertainty	Traditionally a key source of finance for energy projects. Extensive experience but wary of new technology
ECAs	Commercial & political risk guarantee and/or direct lending	Risk reduction Improved T&Cs Increased liquidity	Usually tied to equipment or services Process oriented	Equity and equipment sourcing strategy is key to unlocking ECA support. Strategy needs to be defined early in the design stage
PFI/Multilaterals	Term debt providers	Significant liquidity Can fill funding gaps Mirror or better commercial bank terms Implied policy support	Need for additionality Eligible content rules Geographically specific	Proven to be a significant source of funding for large complex projects. Bring direct lending plus potentially mobilising additional funding
Green Banks	Term debt providers	Significant liquidity Policy support	Restricted scope Geographically specific	Relatively recent addition to the funding spectrum. Proving increasingly important for funding of large infrastructure projects

3.2 Level of Engagement / Familiarity with CCS

From our previous experience and the extensive research exercise for this report, it is clear that there is a wide disparity in the level of awareness of CCS and understanding of key CCS specific issues between institutions, and even within institutions. In Europe for example, EIB have been proactively looking at CCS and have undertaken significant initial CCS related due diligence as a result of their direct interaction with many of the leading European projects over a period of some years. The European Bank for Reconstruction & Development (EBRD) similarly see the importance of CCS in meeting emissions reduction targets but face a situation where there appear to be no projects proceeding in the short term in their area of operation, following the outcome of the first round NER300 process. In contrast, a number of institutions that are very active in the power sector and clean energy, have not yet focused at all on the potential of CCS. However, this is not necessarily surprising given recent funding constraints and the fact that relatively few CCS projects have reached the point of seeking commercial finance, let alone commercial operation. Institutions have focused instead on shorter term opportunities with lower delivery risk, a theme we explore further below.

What should be of more concern to the developers of projects that need to raise external debt, is the fairly wide-spread perception in the finance community that CCS is still at the “prototype” or “proving” phase and that they will not be called on to finance the sector for several years (if ever). It follows then that, with the exception of some early movers, many institutions that could be expected to play a key role in the financing of the projects currently under development have not focused at all on the sector let alone CCS specific issues such as integration, storage, capture technology and economics with which they will need to gain comfort before advancing funding. The implication of this is that finance and other support may not be available when required unless these institutions can be encouraged to engage on CCS and this knowledge/confidence gap can be closed. This issue is explored further in Section 5 as in many respects, availability of finance relates directly to the level of risk institutions are being asked to take.

We believe that lack of engagement with the finance community could emerge as a real constraint for the development of the industry in the short term but this is not a new concern. SG and other stakeholder groups have been part of several initiatives over the past two to three years to try to increase awareness and start a dialogue. Notably:

- The Global CCS Institute have put significant resource into promoting knowledge around CCS to facilitate a greater understanding of the industry and this report is tangible evidence of their desire to ensure that the finance community are fully engaged. However, it is noteworthy that the Institute's membership of around 376 institutions includes just two or three potential debt financing institutions;

- The UK Government have held a number of “CCS Stakeholder” events² in London to which they have invited representatives of the finance, insurance and other key stakeholder groups to increase the awareness of the industry;
- SG have sponsored similar events, most recently with the Carbon Sequestration Leadership Forum (CSLF)³ where the financial and insurance community were invited to interact with developers representing active CCS projects to better understand CCS and each other’s requirements to successfully implement projects; and
- Work undertaken by ECOFIN and ETI⁴ (and partly supported by Global CCS Institute) similarly highlights awareness of the sector as a possible constraint on deployment.

In order to fully understand the current level of awareness of institutions it is useful to look at the global industry in the context of some high level observations on the scope of different categories of institutions contacted.

3.3 Regional Differences and Impact on Financing Considerations

It is clear from discussions that there are distinct regional differences in, and level of engagement with, CCS. To a certain extent this is driven by the status of CCS support programs around the world, policy frameworks in place and previous experience. However, at a more macro level, an analysis of the global CCS project development activity suggests a relatively regionalised focus to the industry as illustrated in the following map. Three main clusters are evident in North America, Europe and China.

Diagram 2 – Regional CCS Projects



Source: Global CCS Institute – *The Global Status of CCS 2013*

² Reports of these events can be found on the Department of Energy and Climate Change web site

³ See CSLF web site for a report on the last engagement exercise

⁴ Reports entitled “Carbon Capture & Storage – Mobilising Private sector Finance” (2011) and “Carbon Capture & Storage – Mobilising Private Sector Finance in the UK” (2012)

Drilling down, the nature of CCS development in each region also differs substantially which may help to explain the varied engagement of financial institutions. In the US for example, the following schematic illustrates that the majority of CCS projects are based on non-power applications and almost exclusively focus on using the captured CO₂ for EOR rather than direct sequestration. It is further evident that the fundamental rationale for the project is the generation of several high value products for sale in commodity markets rather than Carbon sequestration per se. This has a material impact on the way a financial institution would approach the project.

Diagram 3 – North American CCS Projects



Source: Global CCS Institute – The Global Status of CCS 2013

In contrast, the picture in Europe is almost the exact opposite. Most projects are focused on power related applications with direct sequestration of CO₂ rather than EOR being the objective. The absence of commodity products produced for sale and in the case of sequestration projects, no positive market income over and above the power revenues to compensate the additional CCS related costs, makes European projects more policy and subsidy dependent than in the US.

Diagram 4 – European CCS Projects

Source: Global CCS Institute – The Global Status of CCS 2013

In Asia, CCS activity is largely limited to Australia and China. In Australia active projects are a mix of power and process related transactions although the main project moving forward is an adjunct to an LNG facility with wider considerations. China is interesting in terms of the scale of ambition and the “can-do” type environment but has limited relevance from a commercial financing perspective, as it is unlikely that external commercial finance will initially play a part in CCS there even though some non-Chinese companies are active in JVs and cooperation projects. There is however, some potential though for multi-laterals to play a part in the sector as early projects develop. Of more relevance to this report is the export of Chinese

equipment, capital and financial support that we are already beginning to see, most recently in the financing announcements related to the Texas Clean Energy Project (TCEP) in the US.

When one looks at the projects currently in operation or closest to implementation, the diversity of approach is obvious.

Diagram 5 – LSIPs Proceeding to Operate & Execute



Source: Global CCS Institute – The Global Status of CCS 2013

The contrast in approach between Europe and the US is very relevant when the perceived cost of CCS (and in fact all low carbon technology) to the consumer is expected to be an increasingly important consideration in deployment. While CCS in Europe is driven primarily by environmental policy, currently relies heavily on subsidy for economic viability and could appear expensive, in North America CO₂ is a by-product of producing other chemicals and can itself be a valuable product for EOR use rather than a potential liability. This is not to say US poly-generation (poly-gen) projects are commercially viable on their own account, but on paper they appear to require less public funding than the European CCS only projects. At a high level, financial institutions would prefer to focus on projects that are fundamentally economic with no subsidy or as little subsidy as possible, but it has to be recognised that in the prevailing market structures most clean energy projects (renewables included) rely to a greater or lesser extent on subsidy for their economic viability.

Policy is also relevant for early projects as demonstrated by the UK for example, where the current commercialisation competition being run by the UK government has attracted significant interest from large scale projects, not least because of the availability of a bespoke CfD incentive to underpin revenues, and potentially up to £1bn of grant funding. With the short-listing of two commercial scale projects, there is some optimism that at least one full scale CCS project will be implemented and potentially commercially debt financed in the medium term. This has had the knock on effect of creating interest in the finance community due to the scale of financing potentially required and the strong relationships with the companies involved in the short-listed transactions. By contrast, a number of cancelled projects in other areas, including the US and Europe and some well publicised cost over runs (Kemper County for example⁵) has made the financial community somewhat more sceptical about the CCS opportunities globally. To those within the industry, it is evident that the suspension and cancellation of projects to a certain extent represents the cleaning out of

⁵ Most recently the Moody's Investor Service note – Mississippi Power Company: Frequently Asked Questions About the Kemper IGCC Project

more speculative projects and in some cases, a failure by governments to support CCS to the same extent as renewables. However, this is not always evident to the financial community from the headlines presented.

It is interesting to transpose on this, the geographical constraints of institutions that we would expect to finance the industry to see where there is a match.

3.3.1 *Multilaterals, ECAs and Public Finance Entities*

Given the geographical constraints placed on these organisations by their operating principles their ability to support CCS is heavily dependent on the location of the projects and/or nationality of the sponsors and equipment suppliers. Taking some generic examples:

- **Export Credit Agencies:** Wide geographical coverage, subject to OECD country risk classification but constrained by rules on eligible content;
- **Multilaterals:** Generally regional objectives defined by member governments/organisations and frequently focused on lower income/emerging markets as a means of promoting economic development. Not constrained by national content; and
- **Public Finance Institutions:** a number of Governments have established or are considering domestic institutions to further policy goals within the clean energy space. These institutions are, by definition, very specifically focused on one country.

In summary then, it is likely that ECAs will play a role in CCS across most of the regions where projects are being implemented, whilst multilateral and PFI involvement may be more regional or even at national level and so are more constrained. This makes the understanding of their requirements crucial when considering partner and contracting strategies.

3.3.2 *Commercial Banks*

Commercial Lenders are complex to categorise as in many cases coverage area is defined by the policy of the individual institution and can range from a focus only on the country of domicile, through regional institutions to large global players with wide-spread local presence in many countries covering Europe, the Americas and Australasia. It is worth noting that of the top ten global project finance institutions (by value of loans provided), half are Asia based, four are European and seven are active globally. Focusing on Americas and Europe as the most active CCS regions, the top banks are markedly different. Of the top ten providers of US project debt, half are North America domiciled, three are European with one Asian. In Europe eight are European and the remaining two are Japanese.

This implies that the financing for CCS will largely come from “local” financial institutions and so will be relatively market specific. The international banks (primarily Japanese and French) are likely to be involved across the different markets, as they have been for LNG, power and infrastructure lending to date. Irrespective of geographical coverage these institutions also have sector strategies, which will also make CCS more or less interesting to them and this has to be taken into account for any liquidity analysis.

3.4 Project Structure & Policy Environment

The structure of a project and the regulatory environment within which it sits can have a very material impact on the way it is financed and the institutions that can be called upon to provide that finance. Several key considerations are:

- **Sector:** Whilst much of the focus on CCS discussion has been around the power sector, there are clearly also relatively low capture cost CCS opportunities in the industrial sector where CO₂ separation is already part of the chemical process or could be incorporated. Whilst financial intuitions already provide debt finance to these sectors and in theory could extend their activities to CCS, the underlying commodity risk makes CCS financing in this area relatively difficult. Taking the iron & steel industry as an example, high purity CO₂ is a by-product of the direct reduced iron (DRI) manufacturing process and should be available at low cost but whilst the steel industry itself can attract financing, the highly competitive and commoditised nature of the global steel market makes the investment in, and long term financing of, the associated CCS infrastructure (pipes and storage) based on this supply alone a very challenging proposition without significant credit enhancement of the steel industry risk. This is the commercial challenge currently being faced by the Abu Dhabi CCS

project, which is basing the first phase of the project on CO₂ from the Emirates Steel company. There will also inevitably be concerns around adding costs to existing low margin global commodity industries and the impact of this on competitiveness. However, in the case of combining CCS with chemical production for example (the poly-gen concept), where there is also an EOR based CO₂ demand the economics may look better, but still traditional project finance banks have been less active in the sector and have yet to be tested on a full scale polygeneration project;

- **Use or Storage?** The ultimate plans for the captured CO₂ may have an impact on how financial institutions perceive CCS. For example, some institutions have concerns on projects relying on policy and subsidy for their viability so on the face of it a poly-gen projects, like Texas Clean Energy or Lake Charles Clean Energy, may be more attractive than a pure storage solution, based as it is, on multiple long term contractable revenue streams. Similarly, the capture of very low cost CO₂ from natural gas processing plants is also attractive. As previously highlighted, there is a very marked difference in the perspective of captured CO₂, depending on whether it is used for EOR (a commodity with value) or directly sequestered (a project with no value but potential liability). However, it is clear that not all CCS can be implemented in areas where they have the good fortune of some US projects with proximity to an existing CO₂ pipeline network and users already used to paying for CO₂ to use in proven EOR operations. In Europe, where there is no existing CO₂ infrastructure or CO₂-based EOR industry, the value is all in the removal of CO₂ for environmental reasons and is thus policy dependent. Use of CO₂ for EOR in Europe is possible but may complicate an already challenging project proposition on early projects, despite the potential financial benefits. A number of traditional power project finance institutions are also not necessarily equipped to analyse a full chain CCUS project whilst they are familiar with clean energy subsidy regimes; and
- **Support Mechanism:** Clear, stable and long term, are all elements that financiers will be looking for in CCS support mechanisms. Providing long term debt to an investment that is not fundamentally viable in most current market structures without subsidy requires absolute faith from financial institutions in long term policy and the enduring nature of the resulting subsidy regime. Without this, they will require extensive financial support from sponsors and/or government until the technology is cost competitive. This will be discussed further later, but negative retro-active changes to a number of renewable incentive regimes in Europe have undermined this confidence and this could be a significant factor in relation to financing early CCS “demonstration” projects if these are not seen to be fully supported by policy.

3.5 Scope of Financial Institution Involvement

The significance of the above factors should not be underestimated when considering availability of financing for CCS as institutions can sometimes take a binary approach when setting policy. Wind is an example of this, where some institutions will finance on-shore wind but not offshore or in one country but not a neighbouring country.

There are clearly marked regional differences in the approach to CCS and in the activity level of the various financial institutions. As a result, we would expect to see:

- ECAs playing a central role in financing of CCS but based on the location of suppliers and sponsors, with project location being of secondary importance;
- Multilaterals and PFIs also taking a crucial part of the financing for early CCS projects but will be less concerned with the source of equipment and rather more focused on project location; and
- Commercial lenders completing the financing plan, but for select projects based on key client relationship involvement and local/regional operating considerations.

Inevitably though, macro issues around policy, project economics, support available and confidence in the consistency of this support will be an over-riding consideration. Despite the depth and proficiency of the project finance market, the complexity of CCS means that all possible liquidity pools will need to be involved in early projects, making the structuring of transactions at all levels crucial to the final financing success.

4. Requirements of Various Institutions Providing Finance

To understand the key drivers for financial institution one needs to drill a little deeper into the fundamentals of what makes a market or project attractive for a financial institution.

4.1 Commercial Banks

Defining the requirements of commercial lenders in relation to CCS lending is a difficult task, as each institution has differing requirements to meet internal policies and sensitivities. However, assuming that the institution is willing to consider financing of CCS (which most of those interviewed were) it is possible to highlight a number of generic “must have’s” that would apply to the majority of commercial banks. This is not intended to be an exhaustive analysis but does provide insight into the way this group of lenders approach risk and specifically, a new sector.

4.1.1 Policy and Regulatory Framework

Under current market structures, the early CCS demonstration projects with some notable exceptions (Gorgon in Australia for example) rely heavily on direct or indirect subsidy or other forms of financial support rather than economic fundamentals for competitiveness. This has very significant implications for how potential commercial lenders will approach the financing of such projects. In a normal power sector project financing, lenders will look first to the cash flows from the market and/or commercial contract structure (including PPAs) for their repayment. However, they will also evaluate the underlying fundamentals to assess the asset value in the event of changing markets or loss of key contracts as the asset is the primary security for their loan. Distilled down, this analysis is essentially looking at the competitive position of the asset versus other players in the market in various “distressed” scenarios. Clearly, the FOAK nature of the early CCS projects, current market structures and additional capex and operating costs associated with CCS mean that without the subsidy a large part of the underlying assets have no real value to lenders in a default scenario. For example, the transport and storage infrastructure associated with the first CCS project is a sunk cost with no other use if the capture project fails. Equally, even in a retrofit project, the CCS component, and potentially the underlying host plant, may have no value to lenders in the event of a failure anywhere in the CCS chain if CCS is technically, environmentally and/or financially necessary for the viability of the host plant.

This is a somewhat simplistic and pessimistic assessment in that there may be some prospect for remedial action to rescue something from a default situation but banks will look at the worst case for CCS based on no precedent and conclude that “White Elephant” risk is real. In effect then they will ultimately be banking the policy and associated implementation framework (including subsidy mechanisms) rather than the fundamentals of the project. It follows therefore, that for CCS to raise commercial bank financing there has to be confidence in long term policy and the enduring nature of the underlying support.

Some countries have a good track record in this area; the UK for example where although there have been several fundamental changes to low carbon support policies over the past few years, the direction of policy has been relatively consistent including the “grandfathering” where changes have occurred. This has helped the UK become one of the more attractive jurisdictions for renewable financing. By contrast, for various reasons Spain and a number of other countries have implemented a number of material changes to incentive schemes that have impacted adversely on revenues and profits of existing projects and undermined confidence for future investment; not only in the countries directly affected but more widely in the industry as a whole. One interesting publication in this respect, whilst not yet incorporating CCS, is the Ernst & Young (E&Y) Global Renewable Energy Country Attractiveness Index⁶. This ranks 40 countries based on various criteria including importantly prioritisation of renewables (level of political support, importance of decarbonisation, competitiveness) and macro stability (economic and political).

The bottom line is that confidence is essential for mobilising finance and to move the perception of CCS from being an experiment dependent on subsidy, to being a core component of low carbon policy with widespread

⁶ The latest version can be found on the E&Y web site through the following link:
<http://www.ey.com/UK/en/Industries/Cleantech/Renewable-Energy-Country-Attractiveness-Index>

support in the mind of the finance community. Confidence is also a fragile commodity in financing as has been shown by the impact of recent renewable regulatory changes in Spain for example.

4.1.2 Technology

We consistently hear that much of the technology for CCS is not new; it has just not been used on this scale and/or operated in integrated chain before. For a financial institution, scale up and integration have proven, through bitter experience, to be very real risks with real financial consequences. Any proposed CCS project presented to the banks, irrespective of the technology used, will therefore be subject to detailed technical scrutiny and financial institutions will reflect any resulting uncertainty in the debt sizing, commercial terms and the support they seek from equipment suppliers, sponsors and potentially, government. Harping back to the “White Elephant”, the widely expressed view from those interviewed was that in many cases CCS demonstration is being driven by environmental policy rather than a desire or need by industry to introduce it, so government and/or the consumer should underwrite CCS technology risk and the ultimate risk of failure. Simplistic as this is, it will be the basis of risk allocation discussions with the finance community for early projects until CCS technology is considered proven.

This is why all stakeholders will need to engage sooner rather than later in a debate around technology, risk and risk allocation to apportion risk to those best able to manage such risks in order to facilitate full scale development of CCS as soon as possible.

4.1.3 Risk Allocation

Inevitably, as with the development of all new industries, the risk allocation on early projects will be conservative with sponsors (and lenders) expecting government to take more risk than would usually be the case, but in time a more conventional commercial risk allocation should emerge as technology is proven and confidence builds. The issue with CCS is that there is no risk allocation template that can be readily adapted; we are starting with a blank canvas on which we need to build a new risk matrix and associated commercial structure. In many ways this will be the most significant achievement of further successful demonstration projects as not only will this continue to prove that CCS technology works at scale and can be integrated, but it will create a risk and commercial contractual framework for the industry going forward. This has proven to be the case with the independent power project (IPP) revolution in the US and Europe in the 1990's, and the later Integrated Water and Power Projects (IWPPs) developed in the Middle East. In both cases, risk allocation and contractual structures negotiated for the early projects still prevail as templates today, albeit in updated form to reflect better understanding of risk and confidence in commercial structures.

Looking specifically at CCS, based on our experience to date with a number of projects around the world, risk allocation and resulting commercial agreements are likely to be one of the most difficult areas to agree, not least due to the abovementioned lack of precedent. It is therefore essential that there is early engagement with the finance community as well as other stakeholders such as insurers to ensure that the opportunity to create an enduring risk matrix and commercial template is not missed and also to ensure that the early projects are financeable to the greatest extent possible. On the basis of initial discussions based around a CCS power project, we believe that financial institutions will look at risk in two categories:

- **Business as usual:** Risks that institutions would expect to see, quantify and mitigate in a standard non-CCS power project. Examples could be the following as they relate to the non-CCS elements of the project:
 - *Delay* – typically shared between the equity, EPC contractor, insurance and the project / financiers;
 - *Performance* – again shared between the equity, EPC contractor and the project/ financiers; and
 - *Availability* – typically a risk taken by the equity and project/ financiers
- **CCS Related Risk:** Risks specifically arising from the application of CCS including:
 - Storage failure – whether integrated or separate, lenders would be concerned with the liability associated with a failure of and consequential leakage from a storage facility and it is not clear whether this risk is currently fully insurable. Recent seismic events at the Castor

- gas storage project in Spain will have only served to heighten concerns around storage risk and operability;
- Process failure or underperformance – given the demonstration nature of the early projects, financial institutions will take a conservative stance on performance of capture technology and will likely seek underwriting of the risk from OEMs, Sponsors and potentially, government; and
- White Elephant – As already mentioned, the early stage of CCS development and cost base of a CCS plant in a competitive market, has led financial institutions to strongly express a need to see a “guarantor of last resort” to repay debt facilities in the circumstance where the CCS project does not work or works only at such a compromised level that it is not economically viable to operate the plant.

This theoretical division of risk is fine on paper but the reality of a complex full chain project is that events may not fall neatly into the categories provided. It is highly likely that in practice what starts as a business as usual risk may have consequential impacts that could be considered to be CCS related or that an event may fall into the inevitable grey zone between the two and therefore lead to a dispute in terms of responsibility. It is also far from clear, the extent to which equipment suppliers will be willing or indeed able to stand behind the performance of their technology or the willingness of traditional contractors to offer the turn-key, fixed price, date certain wrapped construction contracts widely used by projects and financial institutions as a basis for mitigating many construction related risks. Whilst the multi-contract approach is widely used and accepted by the finance community in the O&G industry and more recently in off-shore wind, it may not be the case for early CCS projects so a new approach will be required to address this risk.

Definition and allocation of these risks will be an interesting debate between stakeholders but the involvement of financial institutions, insurers and other stakeholders in this debate is essential and was highlighted by a number of institutions as being essential to their own internal processes.

4.1.4 Limited Upside and Unlimited Down Side

One interesting observation from a number of the institutions contacted was the ability of a demonstration project to recover from the financial impact of any issues in construction or commissioning. This stems from the nature of many support mechanisms, which essentially offer a fixed price per MWh of electricity delivered or tonne of CO₂ captured. This approach has two distinct potential downsides for a demonstration CCS project:

- *If you don't generate and/or capture you don't get the subsidy:* The widely anticipated model for CCS projects is that subsidy will be linked to the amount of CO₂ sequestered or generation under a fixed term contract. This is not dissimilar from other renewable technologies or to availability risk on some infrastructure projects, except for the fact that the lack of clear track record for full chain CCS operation makes it likely that plant may potentially experience significantly higher forced outage rates than tradition power plant and these outages could be over an extended period if modification and/or repairs are required. Traditionally one would look to the base case assumptions and insurance cover to compensate but in the case of the early CCS projects it is not yet clear to what extent the technology is insurable, leading potentially to the need for significantly more conservative financing assumptions; and
- *How do you make up for lost revenue later?:* Related to the above, in some systems such as the proposed UK CfD for example, your income is effectively capped on a per tonne of CO₂ or MWh basis which gives very little flexibility to recover early losses later in the project life and will again lead to conservative base cases which feed back into the overall cost of the early projects.

This is an interesting structuring conundrum and will inevitably contribute to the relatively high cost of early projects, as any financiers overlay their own contingencies on those of the sponsors, contractors and other parties.

4.1.5 Risk vs Return

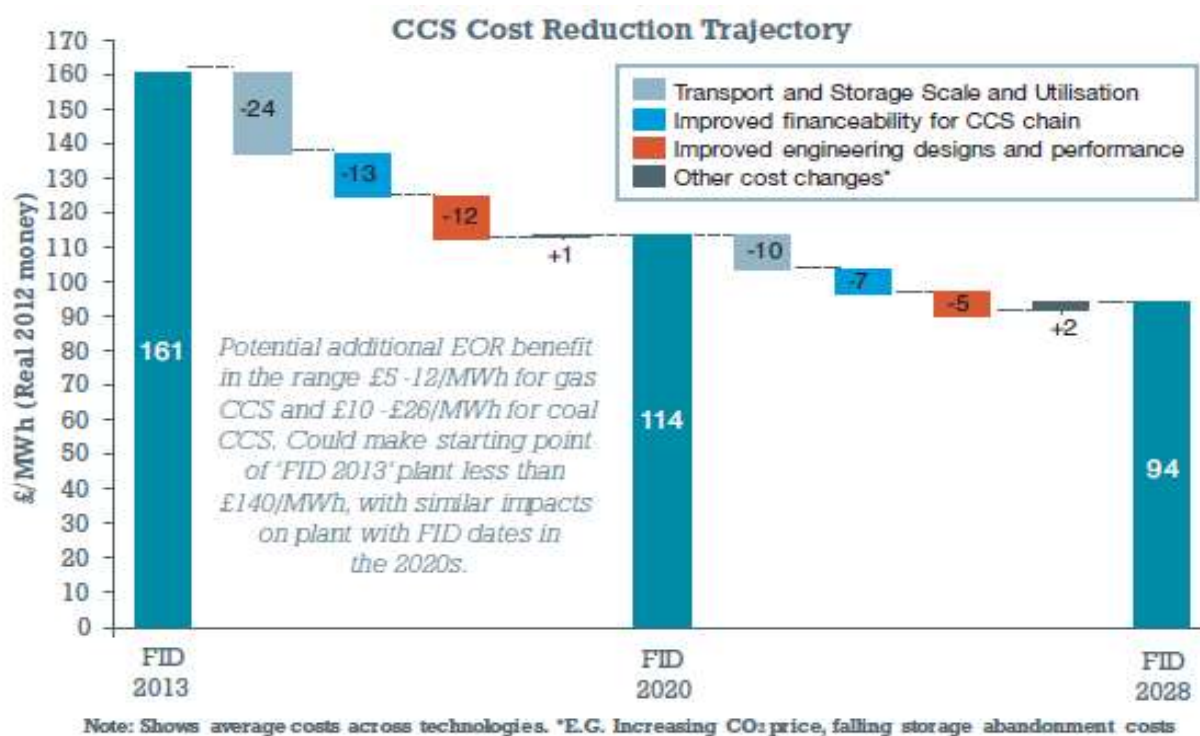
As will inevitably be the case for equity, in the final analysis financial institutions will seek to recover a return commensurate with the risk they are taking. However, there will be certain issues where there is no price at which commercial banks will take on particular risks. This is again why engagement with the financial

community is essential in defining the risk allocation and gaining an early understanding of the risk limitations of each stakeholder to successfully structure the project.

Whilst there are twelve operating CCS projects around the world and others approaching operation, we have not yet seen a CCS project financed in the commercial bank market. However, a number of projects around the world are now starting a serious dialogue with potential financiers and among the most advanced of these is the TCEP in the US, a poly-gen project using CO₂ for enhanced oil recovery. In Europe, of the two projects selected by the UK Government for potential grant funding under the CCS Commercialisation Competition, the White Rose CCS project has been selected on the basis of a funding plan that includes external commercial bank finance. This project is likely to be a pathfinder in terms of defining commercial financing risk and return for CCS without EOR. In Section 9 we look at a number of projects in a bit more depth to assess the options for financing based on the information collected during this study.

One benefit of progressing projects like TCEP and White Rose is that they will fully test and define the full risk allocation and commercial structures for CCS and provide benchmarks for the cost of commercial funding for CCS. Whilst it is too early to say exactly where the risk-return balance will be or how CCS finance terms will compare with say CCGT financing, it seems inevitable, as already mentioned, that the cost of funds for early projects will be relatively high compared to the follow on projects due to a conservative approach on risk allocation and the pricing of risk. Work done by the UK CCS Cost Reduction Task Force on behalf of the UK Government⁷ highlights potential savings in financing cost as a major contributor (around 30%) to CCS cost reduction as the industry develops as illustrated in the following graphic reproduced from the final report.

Diagram 6 – CCS Cost Reduction Analysis



Source: CCS Cost Reduction Task Force – Final Report (May 2013)

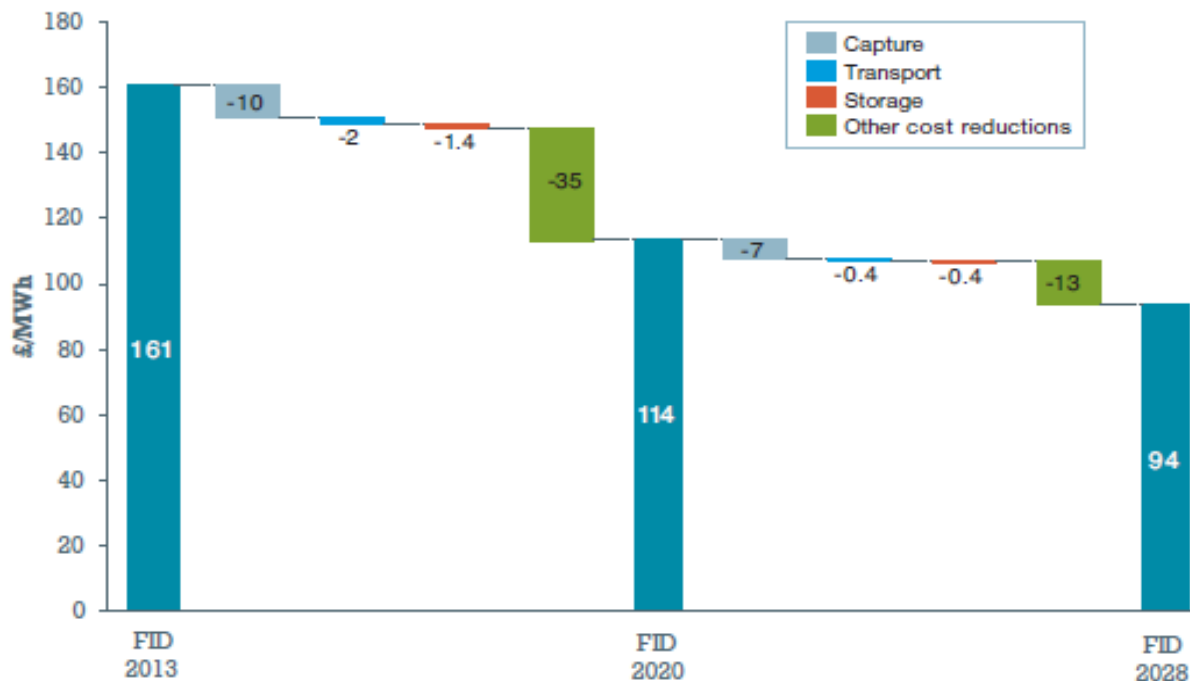
Honing in on the financing cost reduction analysis, the following schematic illustrates that the majority of the financing cost savings expected by 2028 will come from the capture part of the chain and largely reflects the

⁷ UK CCS Cost Reduction Task Force was a group established by the UK Minister of Energy & Climate Change to look at potential for cost reductions for CCS projects implemented in the 2020's compared to the FOAK projects currently being considered. The final report is available at <https://www.gov.uk/government/publications/ccs-cost-reduction-task-force-final-report>

impact of the demonstration of the technology and associated risk reduction in commercial structures. This will manifest its self in a lower cost of risk for equity and more favourable debt terms.

Diagram 7 – CCS Cost Reduction Analysis – Breakdown of Financing Cost Reductions

(N.B. Other refers to savings from other non-finance related sources)



Source: CCS Cost Reduction Task Force – Final Report (May 2013)

This work illustrates the significant cost reductions that can be achieved following the first generation (or FOAK) projects, as increasing operational experience helps to build confidence in the market. However, to fully realise the potential cost reductions a number of follow-on projects need to be developed to build on the first generation or the momentum of the industry will be lost and cost savings will not materialise.

4.1.6 Geography

Whilst not seen as a key issue at this stage, location of the projects will have some influence on how banks perceive CCS projects seeking finance. Based on the policy comments in Section 5.1.1, financial institutions will focus their attention in countries where there is a stable regulatory framework and supporting CCS policy. This is all the more the case for early projects. One other consideration in relation to location is storage. Given issues around public acceptance of onshore storage in some jurisdictions, there is likely to be some sensitivity to this aspect of projects. Finally as we have previously highlighted, the fact that Commercial banks will have target countries within their strategy so will prioritise projects in these countries.

4.1.7 Relationship

Commercial banks are largely driven by relationships and post financial crisis, many focus balance sheet capacity on core clients of the bank. It follows then that for projects in a new sector, with a non-standard risk profile and some policy/regulatory risk, they are more likely to target projects being promoted by, or with a material involvement from, their key relationship clients. This again comes back to the issue of confidence and building the case for the transaction

4.2 Export Credit Agencies

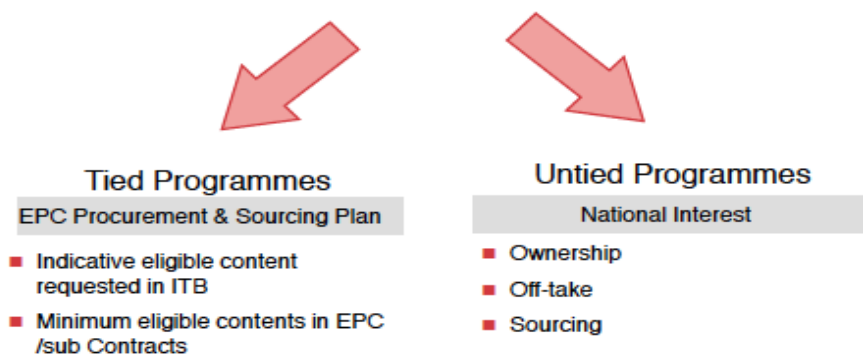
ECAs provide traditional buyer credits with the objective of promoting exports of goods and services from their country of domicile by extending their support to importers and lenders. Conditions of cover and procedures are generally ruled by the “Arrangement on Guidelines for Officially Supported Export Credits” signed by OECD countries or (the OECD arrangement). Whilst ECAs from non-OECD countries do not participate in the Arrangement, conditions of cover offered by most ECAs tend to converge around this reference.

Typically the risks covered by ECAs fall into three categories:

- **Political Risk Cover:** Cover related directly to the consequences of political events impacting the project, including expropriation, nationalisation, political violence and currency availability/convertibility;
- **Extended Political Cover:** Also incorporating breach of contract by government; and
- **Comprehensive Cover:** Cover the consequences of all political and commercial risks resulting in a default by the borrower.

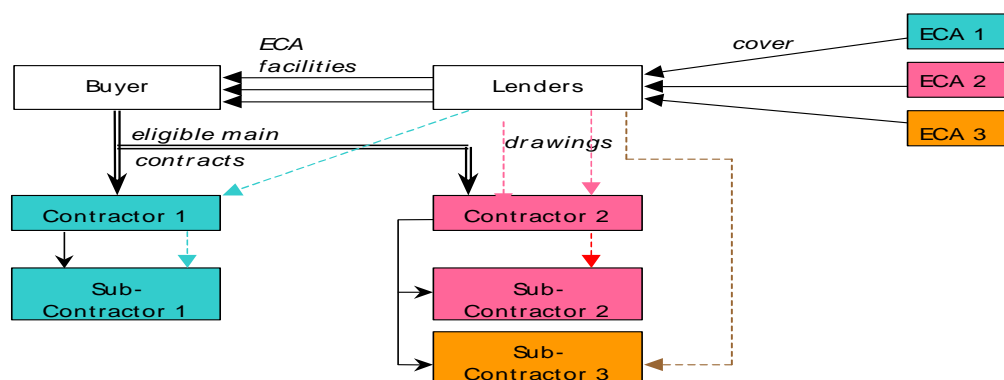
ECA programmes fall into two categories – tied or untied:

Diagram 8 – ECA Options



Untied programmes not ruled by OECD guidelines are a more recent development enabling projects to access direct loans or guarantees based on perceived national interest and usually linked to the nationality of equity ownership and/or the nationality of significant contract counterparties. Untied schemes are mainly provided by the Japanese, Korean and Chinese agencies, i.e. JBIC / NEXI, KEXIM / Ksure and ChinaExim. The more traditional ECA involvement is based on national export content of a project using the following classic ECA structure:

Diagram 9 – Standard Multi-ECA Structure



In order to make use of ECA facilities, developers need to be cognisant of the available programmes and the rules applicable to access the most competitive cover when structuring their projects. Strategy in terms of equipment supply and EPC contracting, and selection of equity partners can have a material impact on the financeability of the project as we will describe later in this paper. It should also be borne in mind that traditional ECA cover is essentially an insurance policy and as such, a premium will be payable for the cover up front or at least during construction so one has to weigh this against the benefits the ECA brings to decide whether it makes sense for the project to follow this route.

Under the OECD rules, the maximum amount of the export contract price eligible for cover cannot exceed the sum of:

- Up to 85% of goods and services originating from the exporting and supporting country; and
- Local costs, i.e. costs in the importing country related to the execution of the contract, can be up to 30% of the amount of the foreign eligible cost.

The 15% of the export contract price not covered has to be considered and should be paid as down payment. The computation of the eligible content depends on the way the ECA interprets the rules and has to be optimised on a case-by-case basis. For example, in some cases the eligible cost could include some “foreign content” such as costs for goods and services sourced in a third country but under the exporter’s contractual responsibility, as well as 85%-100% of the ECA premium and interest accrued during construction.

The OECD consensus also defines some terms and conditions of the credit, including the starting point for repayment, maximum repayment term, repayment of principal and payment of interest. For project finance transactions, the maximum repayment term and the average weighted life of the credit are 14 and 7.25 years respectively, reducing to 10 and 5.25 years when the project is located in a High Income OECD country. The exception to this rule are projects in the clean energy/climate mitigation sector where repayment term of up to 18 years is allowable and the ECAs’ support can exceed 50% of the project cost, even if it is located in a High Income OECD country. Importantly, CCS projects have been designated as being in the climate change mitigation sector and as a result, can benefit from the extended terms irrespective of where the project is based. In order to benefit from these specific provisions, projects will have to demonstrate compliance with low carbon standards⁸ including:

- carbon intensity of equal to, or less than, 350 metric ton CO₂ per GWh vented to the atmosphere. The carbon intensity shall be lower if the plant is fuelled by natural gas; or
- the CO₂ capture and storage rate of the plant reduces its carbon emissions by 65% or greater; or
- the capture rate is at least 85% of CO₂ emitted by the equipment included in the application for officially supported export credits. The 85% is to apply at normal operating conditions.

Developers also have to show a description of the technical and performance standards of the type of project including information on any relevant, existing Best Available Techniques.

Finally, process is very important when approaching an ECA for support so both manufacturers and financial institutions often have ECA specialists within their organisations to manage this. To summarise, the key steps in the approach are:

- **Early Sounding:** to introduce general parameters of the project in order to seek feedback on the qualification of the project, capacity of cover available and likely terms, often in the form of a letter of interest;
- **Application:** Draft Preliminary Information Memorandum (PIM) and term sheet presented together with the detail of the sourcing plan and eligible cover;
- **ECA Review:** Due Diligence (DD) process typically lasting 3-6 months and covering typically the legal, technical, regulatory and environmental aspects of the project as well as the financial model and business plan;
- **Preliminary Commitment:** Conditional commitment similar to financial institutions; and
- **Final Commitment:** unconditional approval just before financial close.

⁸ Source: Arrangement on Officially Supported Export Credits – OECD 16 January 2014
<http://www.oecd.org/trade/exportcredits/theexportcreditsarrangementtext.htm>

Whilst ECAs are very experienced in the energy sector and have worked extensively with the senior project finance institutions and DFIs, they are largely unfamiliar with CCS and will need to go through the same extensive learning process for the early projects. This was borne out by the discussions we have had with a number of the key ECAs in preparation of this report. A number had been approached by, and had in some cases issued letters of support or interest to, CCS project developers but as far as we could determine, none had completed a full due diligence process on a live CCS project. As we describe in more detail in Section 9, Exim Bank of China (ChinaExim), the Chinese ECA, may be the first to do so for the TCEP project as the project has signed a memorandum of understanding with ChinaExim to support the financing for the project on the back of the involvement of Chinese suppliers in the project. This is an encouraging step for the project but may not be a template for the development of the wider industry.

Given the above, one of the key requirements of ECAs in respect of CCS is likely to be time – time to complete the necessary due diligence, become comfortable with the technology and risk allocation and time to obtain all necessary approvals to support the industry. As with financial institutions, it is clear that early engagement will be key to mobilising ECA support for the CCS industry.

4.3 PFIs / Multilaterals

PFIs and multilaterals generally approach the analysis of projects from a similar perspective as commercial banks and even, in some cases, mirror the financing terms agreed between commercial banks and the projects. The difference usually comes in terms of policy, with PFIs and multilaterals having political and/or socio-economic objectives in addition to pure commercial drivers. So whilst many of the observations in Section 5.1 will apply equally to these institutions, additional considerations have to be borne in mind, specifically:

4.3.1 Additionality

As many of these institutions are publicly funded and/or state owned, they are very sensitive to being seen as adding value to transactions rather than being a source of sub-market concessional financing, either in terms of risk or pricing/terms. The test for this is somewhat subjective but put simply, the participation of the PFI or multilateral would not be considered to be additive if a debt financing could have been closed on similar terms by a syndicate of commercial lenders. Involvement is clearly additive if the institution is taking risk that commercial lenders would not take on reasonable terms. One multilateral sums up additionality in three questions:

Is our money really needed?

What risks are we willing to take that others are not?

What services are we providing that others are not?

4.3.2 Facilitation

Whilst not offering an explicit guarantee, many multilateral institutions in particular aim to facilitate commercial bank financing through the implied support of being able to lend alongside an institution which is effectively owned and controlled by government and has government level access to bring to bear in resolving problems. This is the premise behind the “A-Loan/B-Loan” structures offered by institutions such as IFC and EBRD where the commercial lenders co-lend in the B-Loan, alongside the multilateral who provides the A-Loan. In another context, one perceived benefit of lending alongside the Green Investment Bank in the UK for example, is that their involvement signals confidence in the Government policy underpinning the project.

4.3.3 Liquidity

More recently with the global banking crisis, a new role of liquidity provider has emerged where a PFI or multilateral is able to provide the balance of debt required to close a deal when there is insufficient liquidity in

the market (at all or on reasonable terms). We have seen examples of this in the European renewable energy sector where European Investment Bank (EIB) for example have committed relatively large amounts to the offshore wind sector to compensate for a perceived lack of liquidity in the commercial bank markets. Whilst the impact of the global financial crisis is now easing and liquidity is improving, this is still likely to be an important role in CCS (significant investment in a new sector).

4.3.4 Mitigation

Another recent development in the infrastructure finance market is the emergence of multilaterals as a potential “credit enhancement” to facilitate an investment grade rating of projects. The most recent example of this was in respect of the Castor Energy Storage project in Spain⁹ where EIB provided a EUR200m liquidity line to the project to enhance the credit risk of the transaction, and also committed to buy EUR300m of the resulting bond as an anchor investor. This commitment both reduced risk and provided confidence to bring institutional investors into the transaction. Similar structures could conceivably be applied to the CCS sector as discussed later in the report.

4.3.5 Geography

Geography can be a constraint in relation to multilaterals, and in particularly PFIs. Multilaterals are generally mandated to operate in specific jurisdictions, often related to the objectives and stakeholders in the institution. For example:

- **EIB:** Almost exclusively focused on Europe but is now also active in EU accession countries, countries neighbouring Europe, Africa, Asia and Latam, on a case by case basis;
- **EBRD:** Sphere of operations covers approximately 34 countries, mostly in emerging Europe but as with EIB, they are expanding this mandate to countries such as Turkey, Morocco Egypt and Jordan on an exceptional basis;
- **African Development Bank:** Cover just over 50 countries, all of which are in Africa; and
- **IFC** – The organisation has 184 member countries and is active in over 100 countries in Europe, Africa, Asia and the Americas.

Whilst these organisations overlap in some cases, their objectives are primarily developmental and focused on emerging markets so CCS projects in high income economies may not qualify for support. The exception in the above list is EIB, which is able to invest in developed country infrastructure, but none the less, location may be a material constraining factor in accessing multilateral support for many CCS projects.

4.3.6 Sector

Many multilaterals and PFIs target their activities at specific sectors and have policies in relation to sectors where they will not operate. In terms of energy, power generation is generally seen as a priority sector but of relevance to CCS is the fact that a number of multilaterals in particular, have very well-articulated policy in place which in some cases rules out support for coal fired generation. However, whilst both IFC and EIB for example have adopted stringent criteria, which would rule out financing most coal fired generation, CCS fits into the clean energy box and therefore a coal-based CCS project based on coal generation would probably be considered to be acceptable within their guidelines as we understand them.

4.4 Potential deal breakers and road blocks

In our discussions with the various institutions, certain common themes emerged in terms of the risks that caused most concern and of these, which as of today the majority of the institutions would not be prepared to take and others where they would need to understand more before taking a view. To summarise these:



Potential Deal Breakers

Risk that financial institutions are unwilling to take or which may not be adequately mitigated by normal commercial damages/insurance

⁹ http://europa.eu/rapid/press-release_BEI-13-117_en.htm

4.4.1 Storage Risk:

The assumption is that if there is a payment for sequestering CO₂, there will be a commensurate financial penalty for CO₂ leakage as well as the direct physical consequences of the leak and remedial action. There is a substantial amount of published research on storage risk but most of the institutions interviewed had not fully understood this risk and have not researched available information so their starting position was that they would not take this risk either directly or indirectly, particularly if it is also uninsurable. The position differed slightly according to where in the chain the financing was:

- **Full chain finance:** unwilling to take the risk as a significant storage failure could bring down the project, impair the asset security value and have material knock on consequences;
- **Financing of T&S infrastructure:** Similar position to the full chain but with the additional concern that the revenue for providing this service may be insignificant in comparison to the potential damages payable in both directions; and
- **Financing the capture plant only:** Given the perceived indirect nature of this risk, there was more flexibility to consider risk mitigation such as support from a credit worthy T&S operator, insurance etc, but the primary concern was the extent to which any storage related failure could threaten the operation of the capture plant and whether damages or other mitigation would be sufficient to cover this.

Storage risk could be considered to be a “low probability-high impact risk” but is still one area of which most financial institutions have very limited understanding and do not therefore want exposure to. Essentially they currently view storage as a potentially unquantifiable risk from a financing perspective. It is an area however, where some work has been put into trying to quantify the risk and various reports, including one from the Global CCS Institute¹⁰, indicate that the risk is quantifiable and is low. It remains to be seen whether ultimately financiers and insurers are able to take this view.

4.4.2 Technology failure:

One of the prime concerns of the finance community, specifically in relation to the early CCS projects, is that on completion, a CCS plant would not work or would not work at a performance level that made it economic to run. Again this view is based on the current level of knowledge and understanding of the available technology but reflects the “white elephant” concerns around CCS as a whole. The common comment was that demonstration of commercial scale CCS technology is in many cases being driven by government policy so ultimately government should “back-stop” the risk of complete failure and in some cases, partial failure, over and above the potentially enhanced damages provisions under EPC contracts.

4.4.3 Change in Law/Regulation

Given recent, well publicised retroactive changes to a number of European renewable incentive schemes, there is significant sensitivity in the financial community to change in law risk and this was particularly highlighted in the case of CCS due to the potentially high cost of the early demonstration projects. The approach of the finance community to this issue is similar to that of technology – government is sponsoring the proving of the technology at an agreed return for the risk being taken and so they should underwrite the risk of policy /regulation changes through appropriate change in law provisions or other substantive mitigation. This risk may be less of a concern in the US for example where support is more commonly in the form of up-front grant funding.



Potential Road Blocks

Risk that financial institutions may not be able to take or for which financial and/or structural mitigation may be significantly outside normal boundaries

¹⁰ Storage risk assessment report ref: <http://www.globalccsinstitute.com/publications/carbon-capture-and-storage-approach-understanding-potential-risks-and-their-cost>

4.4.4 Storage Risk

In addition to the impact of complete storage failure, some concern was expressed about the long term operability of storage facilities leading to risks in areas such as capacity, injection rates or any other issues that may lead to disruption, rather than a full failure of the storage facility. The concern here is two-fold in that any related outage impacts on the whole CCS chain but also that the cost, if unbudgeted, may not be recoverable from the revenues allocated for the T&S part of the project chain. Following the recent seismic issues attributed to the Castor gas storage facility in Spain, there is also concern that a similar occurrence on a CCS storage facility could interrupt operations for an extended period or conceivably, indefinitely. At this stage it is difficult to see how these various interconnected concerns can be addressed and there is a need for further detailed due diligence to build on the experience of projects such as Sleipner in Norway and In Salah in Algeria to quantify the risks and see whether an acceptable solution can be achieved.

4.4.5 Non performance of technology

This is distinct from Section 5.4.2 above where the technology fails completely, and is seen as a much more likely scenario. The concern is that the project can be made to work but only with additional investment and after significant delay, and then maybe not at the design performance level. This has been the case in a number of situations including for example, the development of a number of IGCC projects in Spain and Italy in the 1990's and with the introduction of the new generation "F-class" gas turbines in the early 2000's. In general, financial institutions appear willing to take this risk to a certain extent but will undertake extensive DD and will look for significantly more support from equipment suppliers, contractors and potentially government than would normally be the case for a standard project. The level of support required will only be known following due diligence and the commercial contract negotiations that will take place on the early projects. One could also expect that with no precedent, the early risk allocation in this respect would also be very conservative, but improving with subsequent transactions reflecting the experience of the earlier deals.

4.4.6 Integration Risk

Integration is one area that financial institutions identified as a risk but were unable to rate in terms of potential impact except to say that it was a significant concern. Fundamentally, the concern is with the number of interdependent components in the CCS chain and the potential for problems in any one to bring down the whole chain (so called "project-on-project risk"). Views varied on whether it was preferable to be financing the whole chain and internalising this risk or just one part of the chain with reliance on contractual arrangements for mitigation. The conclusion of the majority was that this was an area requiring extensive due diligence and modelling in order to quantify the risk and decide to what extent the financial community can accept some exposure, if any.

EOR represents a further extension of integration risk, but there is some regional specificity in this area. In the US for example, there is an established EOR industry in Texas based on naturally occurring CO₂ and a transport infrastructure of over 1,500 miles of dedicated pipelines. This means that there is some familiarity (and practical experience) with transporting CO₂ in pipelines for EOR and crucially, CO₂ has a value. By contrast, in Europe experience of EOR is limited and there is no similar CO₂ pipeline network so institutions are less aware and more concerned about this aspect of CCS. Can we take comfort from the US experience? To a certain extent, yes, but most of the proposed CCUS (Carbon Capture Use & Storage) plants targeting EOR in Europe are based on off-shore fields, thus increasing the level of complexity as far as potential financiers are concerned. In most cases then, EOR is perceived as an added complexity on an already complex project even if it is potentially also a revenue stream.

4.4.7 Operability

Under most renewable incentive schemes, the incentive tariff is only earned on MWh of clean energy produced or potentially in the case of CCS, tonnes of CO₂ sequestered, so the availability of the project, ability to dispatch and economic life among other things have an impact on the revenues and thus debt service. In common with integration, this is seen as a significant potential area of risk, and in fact is also linked to integration/chain component failure.

4.4.8 Long term viability

A number of the institutions interviewed highlighted the potential issue of operating a demonstration plant over a long-term time horizon within the potential constraint of a fixed tariff. Specifically, O&M costs, equipment life, consumables and degradation are some of the areas seen to have the potential to erode economic viability of the project in the medium to long term, although the expectation was that the due diligence, base case assumptions and financial structuring may be able to effectively mitigate this risk.

4.4.9 Transient equity

By transient equity, we refer to the situation where either equity providers seek to recover as much of their investment as possible in the early years of the project and/or where their motivation is to prove technology and sell out as soon as possible after completion of construction. Whilst financial institutions fully recognise the need for commercial returns, they are likely to enter the financing of the early projects in part because the sponsors of these projects are large relationship clients of the institution. For this reason they will be looking for long term commitment from the sponsors until at least a proven period of stable operation has been achieved and even then may also seek to control how and to whom equity can be sold due to the above mentioned concerns on longer term operability. This is not so different in concept from a standard project financing but we would expect the terms of ownership clauses to be more stringent to reflect the increased risk of early projects.



We don't know what we don't know
"We will deal with that in Due Diligence"

In discussing risk and risk allocation with a wide range of financial institutions, it is clear that whilst some have looked in depth at some of the many issues around CCS, the majority have not yet had the opportunity or motivation to do so. This raises an interesting dilemma for the financing of the early projects because absent a real transaction to evaluate, many institutions will express interest and support but subject to full due diligence, risk allocation, modelling etc; in effect reserving their position on key issues that they have not yet assessed. During our research a common response to questions around technology, integration, storage and transport was "we will deal with that in due diligence" – a classic kick-the-can approach.

This is not an uncommon approach in the finance community for new technology but it does introduce a further layer of risk in the early-stage projects as the ability to get comfortable with these risks and on what terms is uncertain, and there is always the possibility that something may ultimately prove to be un-financeable. This again underlines the need for projects to engage early and work with the financial community as projects develop to ensure that risks are understood, evaluated and allocated in a way that is acceptable to financial institutions and any problems are identified well ahead of when financing is actually needed.

4.5 What Price Risk?

In looking at the requirements of potential institutions in respect of financing CCS, it would be wrong to assume that every risk has a price. Many institutions, particularly a number of the more experienced commercial banks, expressed the view that whilst they had the capacity to assess, manage and price risk, in the specific context of financing CCS there may be risks that they would not be prepared to take at any price. It was difficult to drill down on this beyond generic risks like "storage" and "technology failure" as described above as most had not really evaluated issues in detail so at this stage we consider this to be a cautionary position pending full DD.

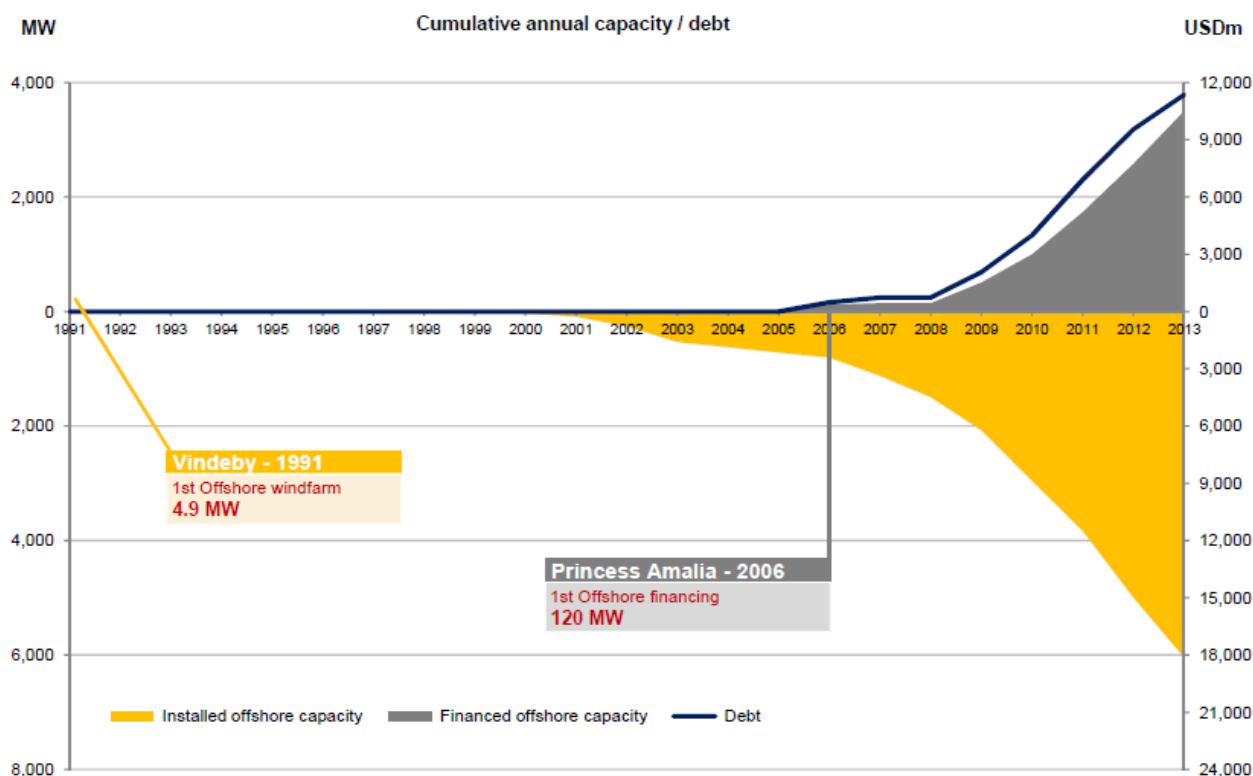
Related to this, institutions also made the point that whilst easing, they still had some financial constraints on their balance sheet and a relatively strong pipeline of transactions in various sectors looking for finance, so they were able (or even compelled) to be selective in where they used their balance sheet. With new banking regulation and controls such as Basel 3 for example, this selection process is inevitably biased towards higher quality of risk given that capital consumption increases disproportionately as the credit rating (internal and/or external) falls. The risk is that the FOAK nature of early commercial scale CCS projects could mean that they fall into the "too difficult" box for some of the less experienced commercial banks. However, we would not expect ECAs, multilaterals etc to fall into this category due to the strategic rationale many will have

to support the industry, and their involvement may in the end be crucial in bringing in some of the more marginal institutions.

4.6 Lessons from Other Areas

Overall, whilst the task of raising financing for a new industry can appear daunting, not least because of the need to understand the needs of the various financing stakeholders in order to get them to the table, the encouraging thing is that this is a path that has been travelled before. The off-shore wind industry for example faced many of the same challenges some years ago but has now largely worked through them. The result is a growing debt liquidity pool for the sector enabling the financing of a pipeline of EUR1bn+ projects around Europe. However, it is important to note that as far as financing is concerned it took some years and significant equity investment in early projects before the finance community felt comfortable enough to start to lend to the industry in a significant way as illustrated in the diagram below.

Diagram 10 – Development of Offshore Wind Farm Financing



We are not suggesting that the lag from the first small test projects to first commercial financing will be the same for CCS as it was for off shore wind as the global focus on environment, policies and regulatory frameworks have evolved significantly in the past few years. However, even now, the universe of lenders for the offshore wind sector is relatively limited (20-25 in total) and the level of risk these institutions are willing to take is less comprehensive than for thermal power, but is rapidly evolving. Some key observations on the development of off-shore wind may translate to CCS including:

- **Strong policy support:** In a number of European countries, real interest in the sector only came when off-shore wind was positioned at the centre of low carbon generation policy and in many cases supported with long term capacity goals/targets in national energy plans. This has also been backed by attractive Feed in Tariff (FIT) or green certificate mechanisms, which provided sufficient returns to attract large investors to kick-start the sector;
- **Technology development:** The proving of technology on early projects and the involvement of major OEMs, EPC contractors etc in the industry provided comfort on the deliverability and operability of projects although the pace of change of technology, particularly turbine equipment, remains a challenge as it did in the gas turbine market in the 1990's;

- **Strong and capable sponsors:** The most successful projects were able to attract finance partly because they were sponsored by large energy companies, with substantial financial and technical resources, and established relationships with commercial banks, ECAs, multilaterals and other sources of financing. This enabled them to develop suitable risk allocation matrices, whilst also having the capacity to manage and absorb some risk, particularly construction risk;
- **Contract Structures:** whilst not implemented on a classic turn-key fixed price basis, offshore wind projects have settled on a fairly stable package contract approach for construction to minimise the integration risk. Commercial structures and terms are also starting to gravitate towards a reasonably common template of risk allocation and debt sizing, providing useful precedent for both sponsors and lenders;
- **Role of financial institutions:** Recent large projects have been financed on a multi-sourcing approach, involving project finance, ECAs, multilaterals and green banks all lending in parallel, a model we believe to be particularly relevant for the CCS industry; and
- **Deal flow:** Based on the above, financial institutions could see the potential scale of the industry and see the level of opportunity for them laid out over a period of years in a number of countries and with participation of key relationship clients. This was crucial in terms of justifying the financial and human resources necessary to understand the industry, seek internal policy support and develop bankable contractual structures through which to provide financing.

Whilst it is essential to prove the technology works, the risk for the early CCS projects is that they are seen by the finance community more as one-off experiments/demonstrations in an area that may or may not take off, rather than the first projects in a potentially significant global industry. Our discussions with many institutions suggest that many take the former view rather than the latter at the moment. However, it is essential to learn any relevant lessons from other areas and translate these to CCS to help provide a recognisable reference for the finance community in the absence of direct precedent. One of the key lessons from the development of offshore wind has to be that building confidence and belief is essential for the mobilisation of finance.

5. Appetite of Various Institutions to Lend to CCS

5.1 Generating the Liquidity Base for CCS

Based on the extensive interviews with various potential funding sources and with the above comments in mind, we conclude that there is extensive interest in CCS as a potential funding opportunity and under the right circumstances, significant liquidity could be made available to finance the development of the industry, including the early demonstration projects. However, to summarise a number of key points, accessing this capital requires developers to tick certain boxes with the institutions:

- **Location:** Commercial financing CCS will be easier in markets with clear and supportive regulatory framework and long term CCS policy, and which also have established and liquid project finance markets;
- **Sponsorship:** The presence of strong, experienced and committed project sponsors with extensive bank relationships was seen as essential in providing the confidence required to mobilise the financial community in support of CCS;
- **Risk Allocation:** As indicated previously new = risk in the minds of most institutions so a pragmatic conservative approach on early projects is needed to build confidence for the roll out of the industry;
- **Engagement:** Full engagement with all stakeholders is essential to ensure they all arrive at the destination together and each play their part in the successful implementation of FOAK projects. Failure to embrace this will inevitably lead to failure to finance; and
- **Opportunity:** Financial institutions may not mobilise resources for a single project, particularly a FOAK project, unless they see a material longer-term opportunity from deployment at scale.

In order to further assess how initial enthusiasm can be converted to debt commitments for the CCS industry it is probably useful to understand the process that a typical institution will need to go through to make a commitment to a CCS project. We believe that this process applies more or less equally to any institution whether it is a commercial bank, multilaterals or a PFI even though each may have slightly different perspectives and drivers.

- **Phase 1 – Identification:** There is a need for the finance teams within institutions to first identify CCS as an opportunity. This then triggers preliminary high level due diligence to understand the concepts and decide it is really an area they wish to pursue;
- **Phase 2 – Education:** Presentation of the case for CCS internally during which time a more extensive internal due diligence will be undertaken on both the business case and the sector itself. If the opportunity was considered significant and the sector was new, it would be usual for this work to be summarised in a management presentation and/or strategy for circulation within the institution to relevant management in order to increase awareness of the sector, key issues, clients etc;
- **Phase 3 – Buy In:** The intention of the education process is to win buy-in from management and other key stakeholders for the strategy to target financing in a new sector; and
- **Phase 4 – Execution:** The final stage of the process is the detailed assessment and structuring of an actual transaction and submission of this transaction to management and credit authorities for approval.

Based on the work we have done for this study, the majority of the institutions are currently at Stage 1 – they are aware of CCS, they see some potential and are following the active projects in their region. In many cases, it was too early to assess whether they considered CCS to be a long-term business prospect or a series of one-off projects. Based on our experience and discussions, moving from “Awareness” to “Education” requires a tangible opportunity and/or a solicitation of interest from a key relationship client. This is demonstrated by the encouraging reaction of the institutions to the progress being made in the UK CCS Commercialisation Competition. Bidders were asked to provide initial comments on risk and financing options and as a result, we understand that a wide range of financial institutions were asked to provide support letters to various bidders backed by key clients. This has generated an increase in awareness and interest among European project finance teams and at least put CCS on their agenda, moving institutions to Phase 2 in many cases.

To provide a support letter, most institutions have to at least seek sign off from senior management and this requires some knowledge building (education) on the CCS, including regulatory frameworks, technology, project structures and high-level risks. However, our research suggests that even with the further short listing of two projects in the UK for the award of up to GBP1bn of government grant funding, institutions have not moved much further than the early stages of the internal education process to date.

In order to really motivate institutions to complete the education phase and present CCS to management to achieve buy-in, we believe that institutions need to be presented with a real transaction, which they consider to have a good probability of proceeding to execution. Despite an increasing number of CCS projects entering into commercial operation, none have yet been project financed and relatively few CCS projects under development are targeting commercial debt funding so there has been little or no opportunity to engage the finance community in a meaningful way up to now. The most advanced projects in this respect are the TCEP project in the US and White Rose in the UK, both of which will be seeking to raise debt as part of their funding plan. In Section 9 we look at each of these projects, based on publically available information, to provide a view of how they may be received by the financial markets. These projects are important as they are based in markets with high potential for CCS (Europe and the US) and use two key potential technologies (Oxy-combustion and IGCC) so the financing process for the projects would be the catalyst for defining template risk allocation and financing terms for the industry going forward.

5.2 Appetite for Demonstration Projects vs Nth of a Kind

We have no reason to believe that for well-structured projects in a supportive environment financing would not be available for one or more of the early CCS projects, particularly where these involve multiple contracted product revenue streams. However, initial terms and requirements for this financing will be conservative and as already indicated, there is a real cost benefit to be gained from CCS financing becoming more commoditised as quickly as possible.

Based on other similar new technology developments in the past including independent power project (IPP) development in the US, Europe and Asia, independent power and water project (IWPP) developments in the Middle East and more recently offshore wind nth of a kind projects benefit substantially in terms of cost of funds through improvements in debt structures, including lower base equity requirements, lower margins, reduced base case cover ratios and more relaxed covenants. The ability to bring bond financing into the projects to refinance original debt will often further enhance returns by extending the tenor, back ending repayments and potentially lower pricing.

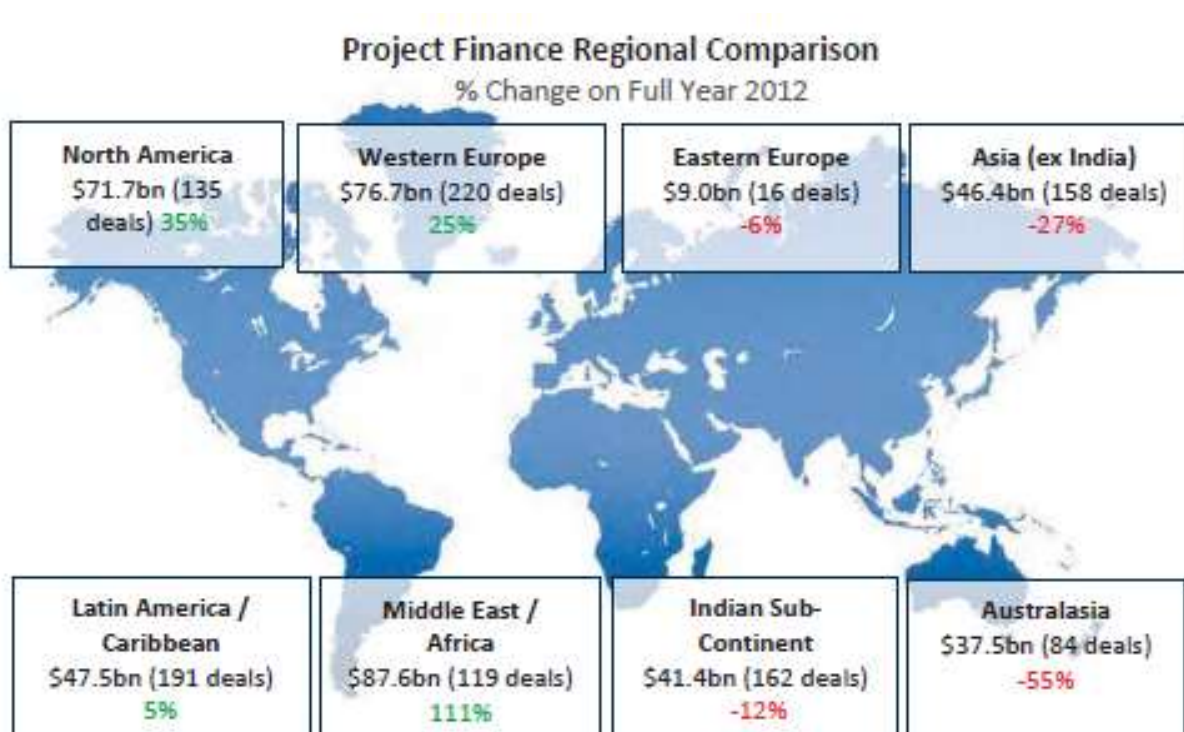
For this to happen there has to be a consistent deal flow in specific markets, whether Europe Americas or Asia, in order to establish risk allocation and documentation precedents and a track record of bankable deals to develop the confidence in the sector.

This is something of a circular path though, as the anticipation of deal flow is part of the lure to get financial institutions to look at the early projects in the first place but delivery of deal flow is essential to hone the terms and structures required to develop the deal flow.

5.3 How Much Funding is Available?

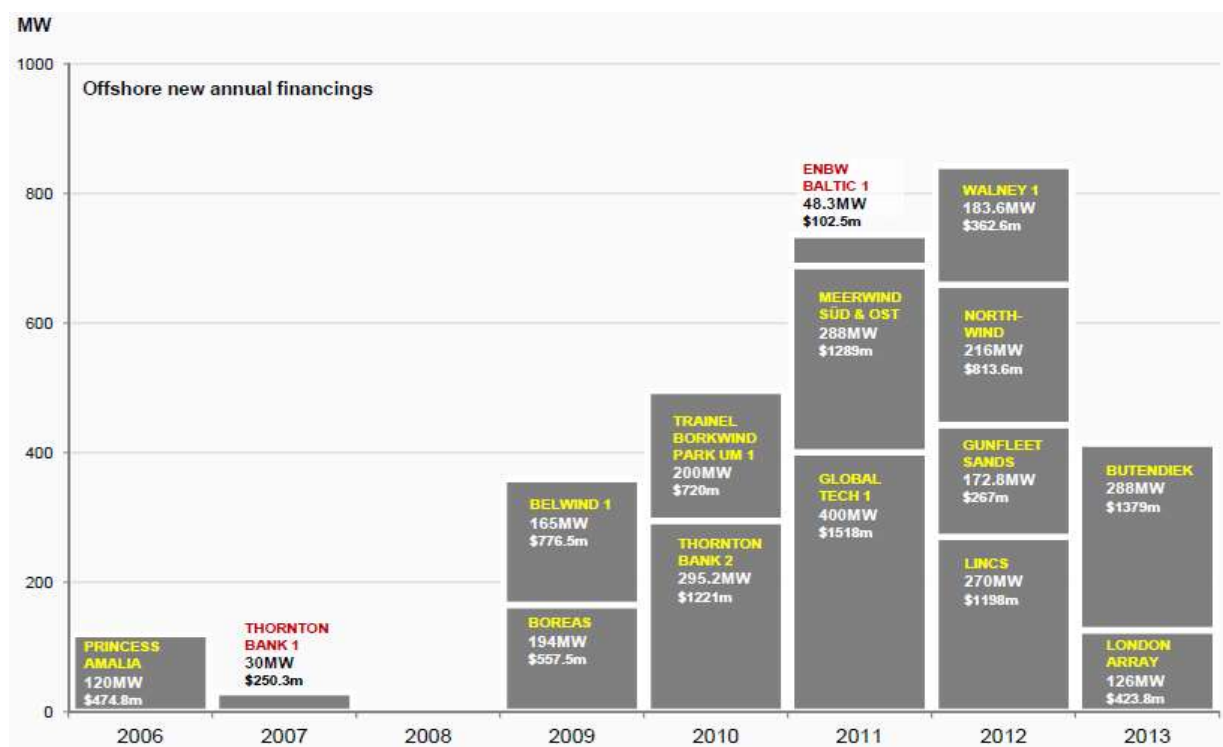
In the current global debt market, this is a difficult question to answer precisely as liquidity varies with so many factors. Globally the energy project finance market in 2012 provided approximately US\$120bn of funding with more than 500 transactions closed. As illustrated in the following schematic, the total global project finance market was well over US\$400bn with North America and Europe accounting for more than a quarter of the activity, with strong year-on-year growth in both markets indicating a return of liquidity.

Diagram11 – Global Project Finance Activity in Full Year 2013



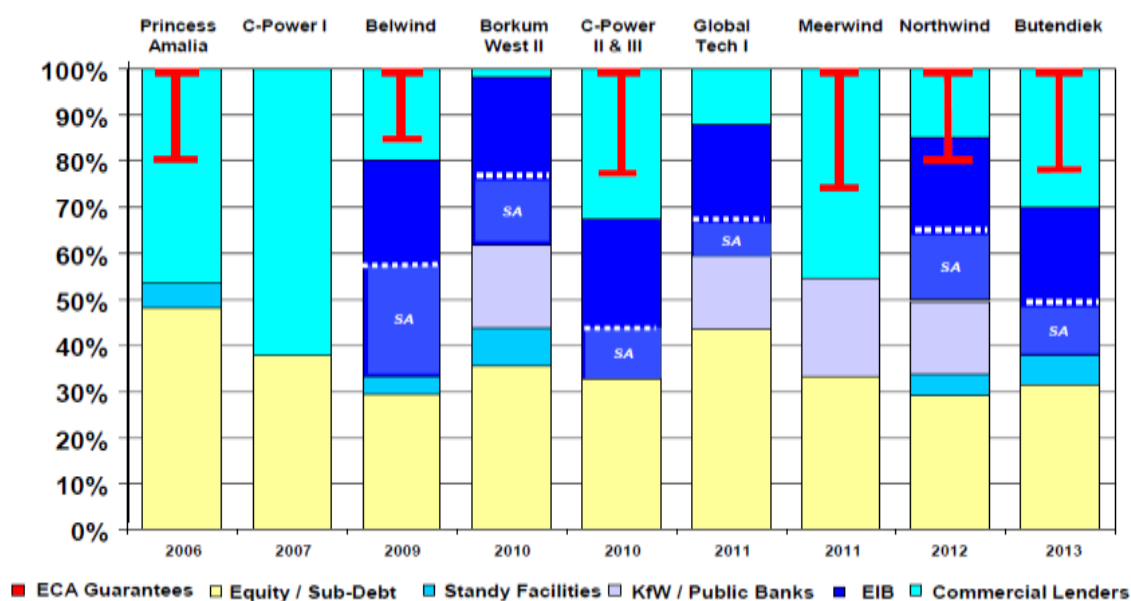
Source: Deal Logic Project Finance Review – Full Year 2012

This analysis would suggest that the US\$3-5bn of capacity probably required to close the first debt financed transactions is a drop in the ocean but as highlighted, CCS has some very specific risks associated with it. For this reason, global liquidity is unlikely to be a good indicator of liquidity available specifically for CCS. A better proxy may again be the offshore wind sector in Europe as this sector has only relatively recently started to seek large scale financing and also has a very specific risk profile with dependence on subsidy to a greater or lesser extent. The graphic below illustrates that significant liquidity is available for this sector with over US\$2.6bn raised in 2012 for four projects and US\$1.8bn in 2013 for two projects.

Diagram 12 – Summary of Project Financed Offshore Wind Transactions

Scale is an important consideration given the likely capex and financing need for the CCS projects so it is also encouraging to note that five projects since 2010 have each raised in excess of US\$1bn in debt facilities, with the largest being the recent Butendiek project in Germany at almost US\$1.4bn in commercial, ECA and multilateral debt.

Breaking this down further to look at the specific pools of liquidity, an analysis of the key offshore wind transactions over the past few years presented by EIB provides interesting insight on potential sources of funding that could also be available to CCS projects.

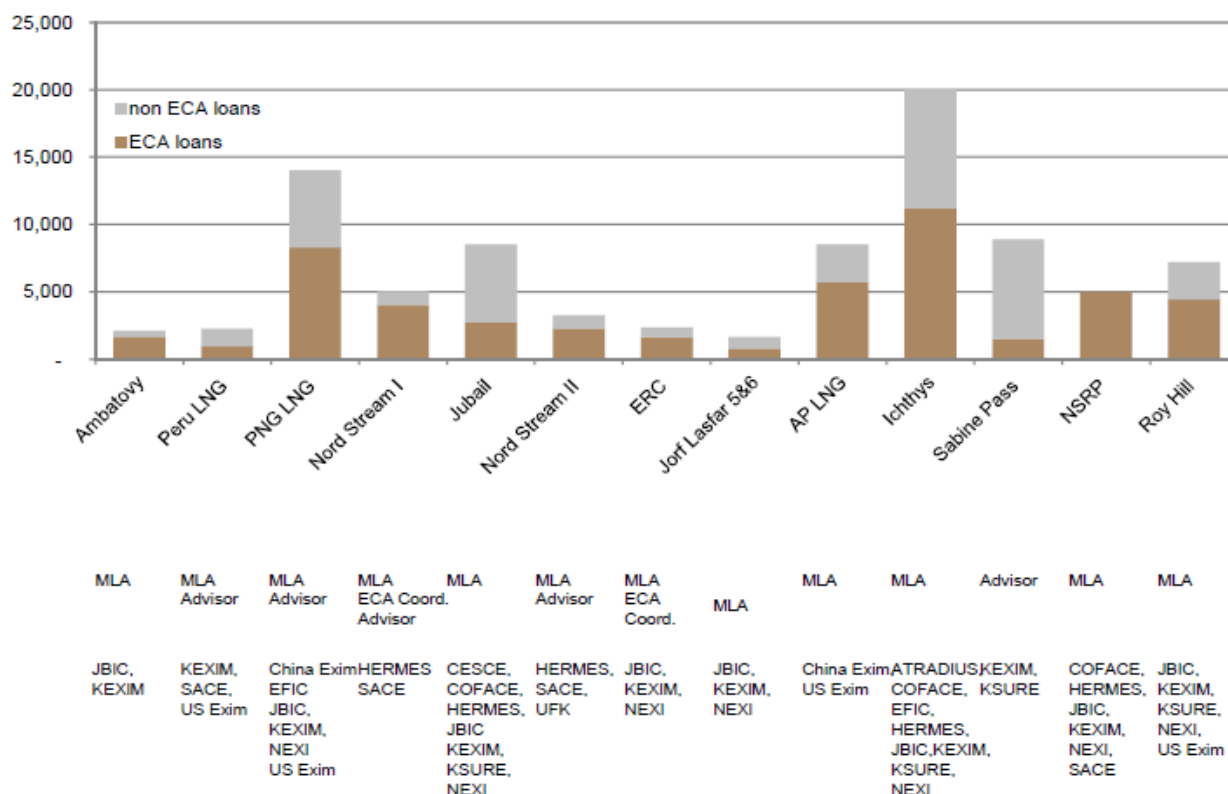
Diagram 13 – Financing Sources for Project Financed Offshore Wind Transactions

Source: European Investment Bank

Firstly, it is interesting to note that the level of equity contribution to transactions, having started in the 40-50% range, has converged over time towards 30% and several transactions currently in structuring confirm this trend. This is a feature seen in previous new markets and reflects the increasing confidence that lenders gain from experience of successful project implementation. In terms of financing structure, whilst commercial lenders still play a significant role, more recently multilaterals and PFIs have carried the bulk of the financing. It is further worth noting that ECAs have provided guarantees for around 20% of the funding requirement, facilitating the wider involvement of the commercial banks. In terms of the capacity of each liquidity pool:

- **Commercial Banks:** The level of commitment available to transactions is dependent on many factors, including internal policy, risk profile and deal size as previously indicated. For large, good quality transactions in well-established sectors institutions are willing to commit relatively large amounts (US\$100-250m in the case of some large projects). However, as a rule of thumb, around 10% of the debt facility and up to US\$75-100m would be a more normal commitment level for a deal in the power sector. This being said, CCS is a new sector so commercial bank commitments may be substantially lower unless the risk profile of the transaction is very strong and “new industry” risk is mitigated. If one assumes that 10-15 commercial lenders may be interested to participate at various levels in a well-structured deal with strong sponsors, commercial debt of up to US\$0.75-1.00bn could be possible.
- **ECA's:** As outlined above, ECA cover is usually linked to “eligible content” so the amount of cover available varies considerably depending on location, equipment source, sponsor domicile etc. However, one of the key benefits of ECA cover, in addition to any direct lending they are able to offer, is the leveraging effect it can have on commercial bank commitments. Institutions may be attracted to a deal they would not otherwise have considered or able to lend more than would otherwise be the case due to the risk mitigation offered by the ECA cover. For this reason the involvement of ECAs in this type of financing can increase liquidity materially. By way of example, for in a recent US\$1.3bn thermal power sector financing in N Africa, ECAs provided a mixture of direct loans and guarantees for more than 50% of the total project debt and this level, or potentially more, could be available for CCS. The following graphic summarises the involvement of ECAs in recent large-scale energy projects to illustrate their capacity.

Diagram 14 – Project Finance Loans with ECAs



- **Multilaterals, PFIs etc:** It is difficult to generalise on the capacity of institutions in this category as much depends on policy, objectives and other drivers. However, it is clear from the previous illustration that this is a potentially key pool of liquidity as far as a nascent industry is concerned. Usually, these institutions have objectives of support for clean technology, additionality etc that would obviously be met by CCS if the transactions are structured correctly. By way of illustration:
 - **Offshore wind:** The UK Green Investment Bank recently provided £58.6m (22%) of a £266m debt facility raised for a UK offshore wind financing and are actively looking at innovative ways to support the industry including potentially equity as well. The remainder was provided by four financial institutions; and
 - **Renewable Energy:** EIB have been a significant provider of debt to the green energy industry, having committed more than EUR3bn to renewable energy projects overall in 2012.

Based on market soundings we have undertaken, the discussions we have had in respect of this report and available precedents, we believe that there is sufficient capacity in the global debt markets to finance early CCS projects if the risk profile and structures are appropriate, and with the expected support from multilaterals, PFIs and ECAs. To be more specific, we believe that there is sufficient capacity in the global debt market to finance 2-3 large well-structured projects per year (aggregate debt of around US\$1.5-2.0bn). However, from a practical perspective, we are unlikely to see this level of deal flow in the medium term, allowing time for confidence and debt capacity to build more slowly over time on a deal by deal basis as it has in the offshore wind sector.

5.4 Other Sources of Finance

Will CCS be able to access the capital markets?

In addition to the more traditional project debt financing institutions, liquidity could also be available from other sources. Key amongst these is the debt capital market (DCM). There is a significant geographical divergence in terms of the availability of bond type financing for the energy business:

- **Americas:** Well established DCM product offering with substantial liquidity and a track record of financing energy infrastructure. This market is very deep and has been a key source of liquidity in the region for a number of years.
- **Europe & Middle East:** DCM for energy related project finance has developed to a lesser extent than the US. We have started to see some activity in O&G and power asset bonds, most recently for the EUR1.4bn Castor Gas Storage project bond in Spain and the US\$825m Ruwais Power transaction in Abu Dhabi

In terms of US\$ bond issuance, more than US\$13bn of bond financing was closed in the first three quarters of 2013, with almost 80% of this activity being in the energy sector (35% in power & renewables). Volumes in EMEA are less than this and to a greater extent focused on infrastructure transactions.

In terms of attracting bond financing, there are some general characteristics common in successful transactions:

- **Investment Grade:** Whilst there is a non-investment grade market, most energy related project bonds have been investment grade rated. This obviously requires projects to satisfy the financial and structuring requirements of at least two rating agencies to gain an investment grade rating;
- **Operating Assets:** Again, whilst there are exceptions, it is most common to see DCM as a refinancing solution following successful completion of the project and entry into the operating phase as investors have generally shied away from construction risk; and
- **Stable Long Term Revenues:** Bond investors generally look for predictable long-term revenues to underpin the facilities and look carefully at the contractual and regulatory structures that underpin this.

The suitability of early CCS projects for DCM products is an interesting question. In Europe it is likely to be too early for access to bond finance as there remains a need to demonstrate several aspects of the technology and projects will rely heavily on policy for success, with the associated regulatory risk. However, the revenue stream in some markets (the UK for example) could be considered to be stable when the project

is proven and operating so DCM could be a refinancing option rather than a source of primary financing. In the US, the deeper market and higher tolerance for risk could make a bond component to a financing possible, particularly on poly-gen or other product related projects but this still has to be proven so again DCM may not be a primary financing route. We are aware that at least one of the US gasification projects is seeking a DCM tranche as part of their financing plan, and whilst this is essentially a solids to chemicals project with CO₂ capture as a by-product, it none the less would represent a bench mark for others to follow if it is successful.

The role of credit enhancement.....

There have been examples of successful bond financing in projects with relevance to CCS, including most recently the Castor bond financing in Spain. The key feature of relevance for CCS in this case is the fact that capital market financing of this project would have been unlikely without the credit enhancement provided by European Investment Bank.

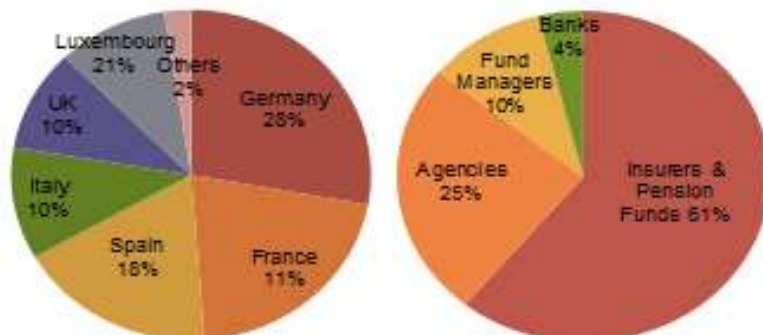
Case Study – Castor Gas Storage EUR1.4bn Bond Financing

The project is an underground gas storage facility off the coast of Castellón in Spain. The project has the benefit of a 30-year concession contract, which can be extended for two additional periods of 10 years. Construction of the project was completed in July 2012. The project is an essential piece of infrastructure for the Spanish gas sector as it provides stability between supply and demand. Furthermore, the reservoir characteristics are unique in that they allow for high rates of gas deliverability when required, represent c. 30% of Spain's consumption and are sustainable for 50 days at the average annual consumption level of 2012.

The key feature of the structure which makes it interesting in relation to CCS is the credit-enhancement provided through a subordinated EIB letter of credit facility. This is the first transaction to be structured by EIB under their EU 2020 Project Bond Initiative. The EUR 200m of Project Bond Credit Enhancement (PBCE) provided by the EIB enabled the transaction to achieve a rating at one notch above the sovereign to underpin the bond issue in which EIB also subscribed for EUR 300m. It is further worth noting that the EUR1.4bn bond has a long maturity (2034) illustrating that the appetite of investors for well-structured infrastructure assets.

In terms of placement, the bond was widely placed with European investors, and much of the issue was taken up by insurance and pension fund investors, who have a long-term investment horizon. The involvement of EIB in this transaction was considered to be key to its success.

Diagram 15 – Castor Bond Breakdown



The EIB EU2020 initiative is one of a number of potential means by which available sources of finance for CCS could be expanded. However, although Castor could be a useful precedent in bridging the gap between the current status of CCS as sub-investment grade and the requirements of the bond market on some transactions, technology and integration risk remains a challenge that may not be addressed by this type of enhancement.

There are a number of other government and private sector schemes around the world that similarly seek to de-risk projects to enhance financing. Specifically in relation to CCS, one such example from the UK is the government guarantee scheme for infrastructure projects.

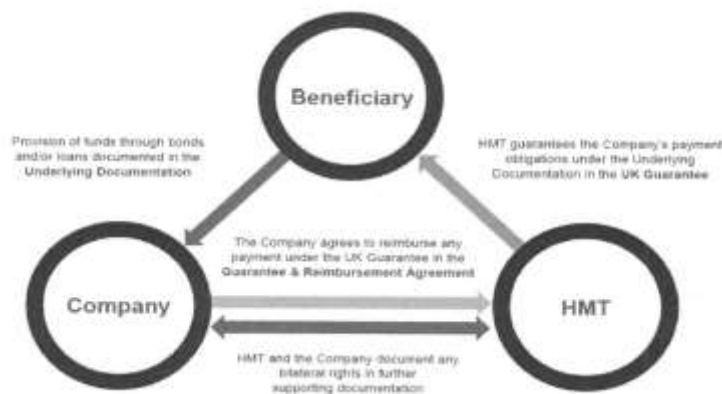
Case Study – Infrastructure UK (IUK)



Infrastructure UK

IUK is a GBP50bn fund established in 2012 by the UK Treasury to provide guarantees in respect of qualifying infrastructure projects in the UK in exchange for a pre-defined fee. The guarantees are in the form of an unconditional and irrevocable financial guarantee of scheduled interest and principal in favour of the lender (beneficiary). The following graphic simply illustrates the guarantee structure.

Diagram 16 – IUK Process Schematic



It is intended that this scheme could be applied to any financing structure, with documentation being tailored to the underlying transaction.

The key benefit of the scheme is the transformative effect it has on financing for the underlying transaction. From the beneficiary's perspective the UK Government (and its rating) is essentially substituted for that of the project, making long term bond financing possible where it otherwise may not be. This is an innovative scheme to support infrastructure development in challenging sectors as demonstrated by the recent announcement of the significant involvement of IUK in the UK nuclear sector. It could also be applied to UK CCS projects although none has so far been prequalified.

The above examples are illustrative of non-traditional structures for increasing the liquidity available for funding CCS projects but are very country specific, policy driven and often limited in capacity. However, for funding an emerging industry with potentially huge capital needs such schemes, in parallel with the on-going operating support, could be essential to raising debt financing.

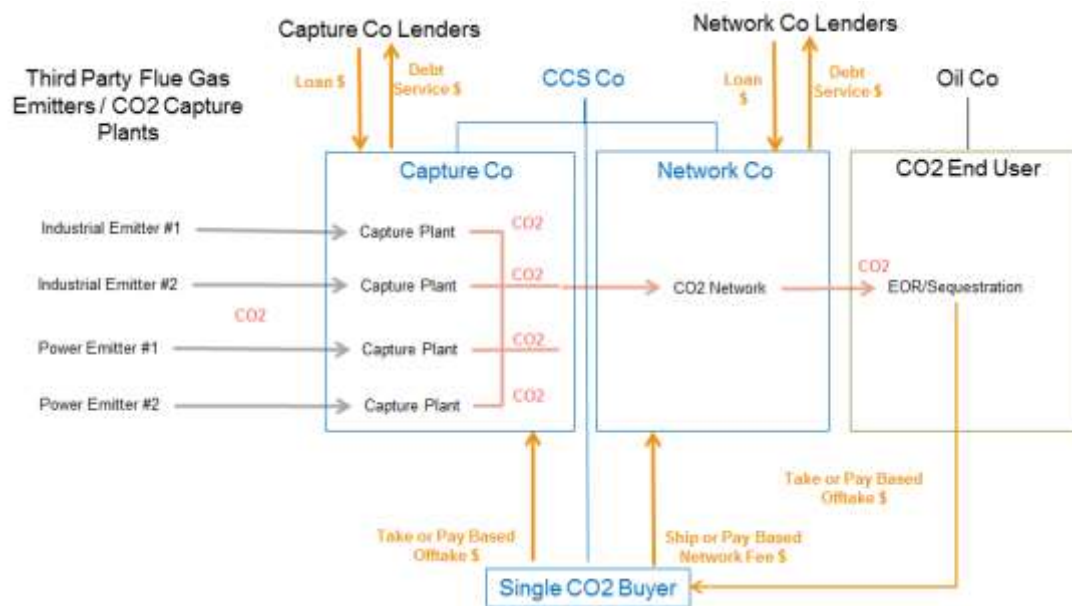
6. Structuring a Project to Access Commercial Funding

6.1 Underlying structural requirements

One of the key aspects of structuring is the commercial framework in which the project will be implemented. The following schematic illustrates simply the different components of the CCS chain and the differing contractual relationships between each element of the structure. The example of a multi-emitter / aggregator

has been chosen specifically as this raises additional issues in terms of access and pricing and is representative of at least one of the active CCS projects under consideration.

Diagram 17 – Multiple Emitter CCS Project Schematic



Leaving aside the CCS / new technology specific risks already discussed at length, at a high level lenders will focus on the following fundamental structuring points:

- **Full chain or individual companies:** Whilst a full chain with single ownership is a more straight forward option, it is not inconceivable that projects will develop with specialist investors taking responsibility for individual parts of the CCS chain. This would then rely on contractual integration rather than equity integration and potentially involve different financings for each step of the chain. The key concern of lenders will then be to ensure that the contractual arrangements adequately protect their interests by allocating risk appropriately, ensuring adequate compensation in the event of failure to perform and having an appropriate counterparty who is capable of performing their contractual obligations and is credit worthy enough to honour their financial obligations;
- **Nature of the contractual arrangements:** Depending on your position in the chain you may prefer to sign a “take-or-pay” or “ship-or-pay” contract. This will then impact on the liabilities of each counterparty and the extent to which these liabilities can be passed through the chain to those best able to manage them;
- **Cashflow and compensation:** Related to the contractual structure, tracing the cash through the chain and ensuring that damages flow back will be a critical consideration for the lenders to a capture project;
- **Third Party Access:** Clearly where the business plan is for the infrastructure to be capable of taking CO₂ from more than one source (Hub type strategy) the rights of the various parties are crucial. In the case of transport and storage for example, lenders to the first capture plant will want to be protected from any adverse impact of subsequent users joining the transport and storage system. This could relate to a range of commercial conditions, including pricing, rights of use, treatment in a system outage etc and will be a concern for financing of the first project but could equally be constraint for financing of subsequent projects; and
- **Usage rights:** For many CCS projects, each step of the chain is interdependent so failure of one component would likely lead all the others failing. An example of this often quoted in discussion with lenders was the situation where the CO₂ End User for example in the above diagram went bust or was unable to accept CO₂ for an extended period as this could potentially mean the insolvency of transport and capture legs of the chain as well with a significant impact on the lenders security value throughout the chain. This may be less of a concern as the industry develops, particularly where there is a hub with multiple storage options rather than point to point projects, but this removes a risk for early projects which are almost inevitably point to point initially whatever the longer term objectives for wider development. In addition, a key protection for lenders to a traditional project

finance asset would be the right to step in and control defaulting assets to preserve value. This could prove problematic where these assets are themselves leveraged and secured to a different bank group.

If one transposes this analysis to a poly-gen project with EOR, many of the issues are similar but in a different context. For example where the project produces urea, power and sells CO₂ for EOR, the integration of individual contractual arrangements is crucial to the overall success and financeability of the project. An imbalance in this relationship, for example where damages payable for pipeline outages were insufficient to compensate payments due under other supply contracts, could have a significant impact on the viability of the project. This is not so dissimilar from integration of fuel supply and off-take in a power plant but is complicated by the larger number of commercial agreements in place.

The assessment and validation of the contractual/commercial structure of the project will be one of the fundamental pieces of due diligence for any potential lending group and will involve legal, technical, insurance, market and other specialist advisors.

6.2 Debt Structuring

Taking a generic view of CCS, it is likely that the first commercial financings will be based on relatively conservative assumptions compared to the typical financing of the underlying industry. For example, if one makes a comparison between key debt sizing parameters for a CCGT project and a power project fitted with CCS it would not be unreasonable for the comparable structuring terms to be as follows, but again with the caveat around appropriate risk allocation:

Table 2 – Key Debt Structuring Criteria

	CCGT	CCS Project
Debt to Equity	70:30 to 80:20	50:50 to 60:40
Debt Service Cover Ratio (DSCR)	[1.20x to 1.25x]	[1.35x to 1.45x]

It should not be a surprise that a CCS project is likely to ultimately have less debt capacity than a CCGT project, where there is a long track record of successful financing and clear precedent for the financing. Putting this in context, an 850MW CCGT has a capex cost of very approximately US\$1.0bn whilst a typical commercial scale CCS project maybe half the capacity for two to three times the cost, say US\$3.0bn. When the above leverage metrics are applied to these costs:

Table 3 – Comparison of CCS with CCGT Financing

	CCGT¹¹	CCGT CCS	IGCC CCS¹²
Power Output (Net)	910MW	750-800MW	524MW
Capital Cost	US\$1.2bn	US\$3.0bn	US\$4.0bn ¹³
Debt to Equity	75:25	50:50	Equity financed [50:50]
Equity	US\$300m	US\$1,500m	[US\$2,000m]
Debt	US\$900m	US\$1,500m	[US\$2,000m]
Cost US\$/kW net	US\$1,320	US\$3,750	US\$7,633

The most striking observation from this analysis is the significant increase in equity commitment (non-debt funding) required, increasing by more than five times for less installed capacity in the case of CCGT CCS. The debt also increases substantially due to higher total capex, but by less than 50%. This is very significant for sponsors of CCS projects and illustrates why a number of projects have struggled to raise necessary

¹¹ Recent European CCGT development

¹² Based on Kemper County IGCC project in the US - Source the Moody's Investor Service note – Mississippi Power Company: Frequently Asked Questions About the Kemper IGCC Project. Currently equity financed so gearing figures given for illustrative purposes only.

¹³ Plant excluding mine and CO₂ pipeline

financing for implementation without substantial support from grant funding or other subsidy. This also very graphically illustrates why the current UK CCS Commercialisation programme could offer a “golden ticket” to the selected project or projects as up to GBP1bn of capital grant funding could, depending on the terms, be considered by financial institutions to be equity in the funding plan of the projects, thus reducing the shareholder funds required to closer to a standard project. In view of the FOAK risk associated with early CCS projects, such public funding is expected to play a material role in making projects financeable. However, coming from another angle, additional revenues associated with a Carbon Capture Use & Storage (CCUS) project can also offset the additional costs associated with CCS and, given the additional contracted revenues, debt sizing can be calculated over significantly more dependable revenue than for a simple CCS-power project, and so reduce the equity required.

As already highlighted in Section 5.5, it is likely that the experience from successfully financed projects will lead to a substantial improvement in the debt sizing parameters, significant reduction in equity and an improvement cost of funds for the projects. However, early projects will need tangible support to raise financing in order to reach this position.

6.3 Indicative Debt Terms

In the absence of tangible CCS projects to finance, there is little precedent on which to base an indicative term sheet. However, based on similar emerging sectors, we believe that the following could be reasonable financing assumptions for the commercial debt on early projects:

Table 4 – Indicative Debt Terms for a CCS Project

Tenor	10-12 years including construction (could increase to 15-17 with ECA support)
Gearing	50:50
Upfront Fees	275-350bps
Margin (over base rate)	325-375bps (ECA backed debt could be closer to 185-215bps)
Commitment Fees	40% of margin
Amortisation	Sculpted repayment to a minimum debt service cover ratio Potentially, ratio or event driven cash sweep
Base Case Ratios	Minimum [1.5]x Distribution lock up [1.2]x
Other Requirements	DSRA for at least 6 months interest & principal Maintenance Reserve Account (MRA) depending on technical DD Hedging of interest rate exposure Credit support for key contractual obligations Direct agreements and security rights over the project and potentially essential third party assets (shared facilities, T&S infrastructure etc)

Clearly in the absence of precedent, these projected terms are at this stage very indicative as the factors influencing a financing are many and varied. As also highlighted above, there are significant regional differences in the approach to implementation and the nature of the projects as well as of course, the technology being deployed.

In reality, the scale of the early commercialisation projects is such, that if they are to be financed in the debt markets, they will need to be attractive for ECAs, multilaterals, PFIs and commercial banks so the ultimate terms on which a CCS financing will be closed will be the lowest common denominator of all the institutions needed to close the deal.

7. Forum Shopping – organisational and regional differences in appetite and interest in CCS

In terms of shopping around in general, the current nature of the industry is such that this starts with the fundamental choice of project location in order to take advantage of the best support policy and we have seen a number of projects “relocated” in order to take advantage of a perceived better environment. Location and underlying support is crucial for the early projects as manufacturers of CCS related equipment seek to prove their technology and early mover equity seeks to establish a lead in the business.

From a financing perspective, it is very clear that for early projects sponsors will need to be pragmatic and seek support from a wide variety of sources but without necessarily having the ability initially to arbitrage one against another as for a more developed sector. Having said this, there is an opportunity to shop around the ECAs, to take advantage of regional differences and appetite in order to optimise financing packages. In our discussions, it became clear that there is an element of competition between ECAs to support their manufacturers and on one market sounding there were significant differences in the level of commitment and enthusiasm of these institutions. This is the one area where there is significant flexibility in many projects – the ability to tailor the procurement and strategic partnership approach of the project to optimise both the amount and the terms of the ECA cover, including the sourcing of direct loans. One very recent example of this is TCEP where having started a dialogue with the banking market, the project changed tack to focus on the strategic benefits of involving Chinese EPC and equity partners who could bring with them attractive financing on presumably more competitive terms and possibly with a higher probability of delivery. We are aware of a number of other projects also following this route and would expect early projects to do so as there is strategic benefit on both sides and could provide insurance or a “plan B” if the traditional bank market does not deliver.

As the industry develops, one would expect the scope for shopping around to increase at all levels, including increasing competition between financial institutions to provide financing. This is however some way down the track and fully dependent on development of a number of projects which should increase the potential competition for financing and enable truly competitive financing of CCS projects.

8. Practical Application of financing concepts

Unfortunately, the absence of CCS projects developed using commercial debt facilities makes it impossible to present full case studies to illustrate practical implications of the issues discussed in this report. However, we considered it to be a useful exercise to look at a number of the more advanced projects that we believe are now seeking, or may seek, commercial debt financing to assess potential financing options and the approach potential lenders may take when assessing the projects. We need to stress that the following assessments are based on publically available information and do not necessarily represent the final financing strategy of the project sponsors for these projects.

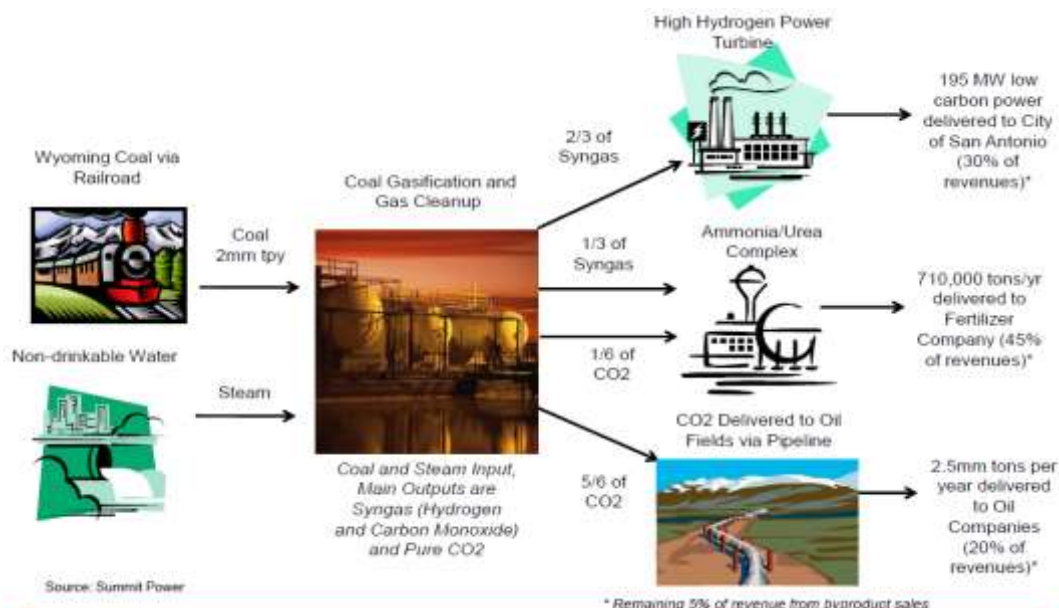
8.1 Texas Clean Energy Project (TCEP), USA

The Texas Clean Energy Project is being developed by Summit Power, a US power project developer that specialises in sustainable energy projects, and consists of a 400MW coal-based IGCC power project. The synthetic gas (syngas) produced and CO₂ captured in the gasifier are used for a number of industrial processes, including power generation and urea production, making it a good example of both a pre-combustion CCS project and a poly-gen project. The project has been designed around the poly-gen concept from inception due to the perceived benefits to the economics of the project and as a demonstration of an approach that could ultimately become a reference plant for similar CCS ventures around the world. The focus for the Summit has been to develop a project delivering a market-based return over a typical infrastructure time frame of 20 to 30 years with minimal subsidy in order to demonstrate that CCS projects can be commercially viable and capable of securing the necessary funds on a project finance basis.

Participants in the Texas Clean Energy Project FEED study launched in June 2010 include Siemens Energy Inc., Fluor Corporation, and the Selas Fluid Processing Corporation (a subsidiary of Linde Group). Latest cost estimates for TCEP give a total cost of in excess of US\$3.0 billion due to recent cost increases in the Texas construction market.

The following diagram provides an over view of the poly-gen concept for the project, illustrating the various revenue streams generated.

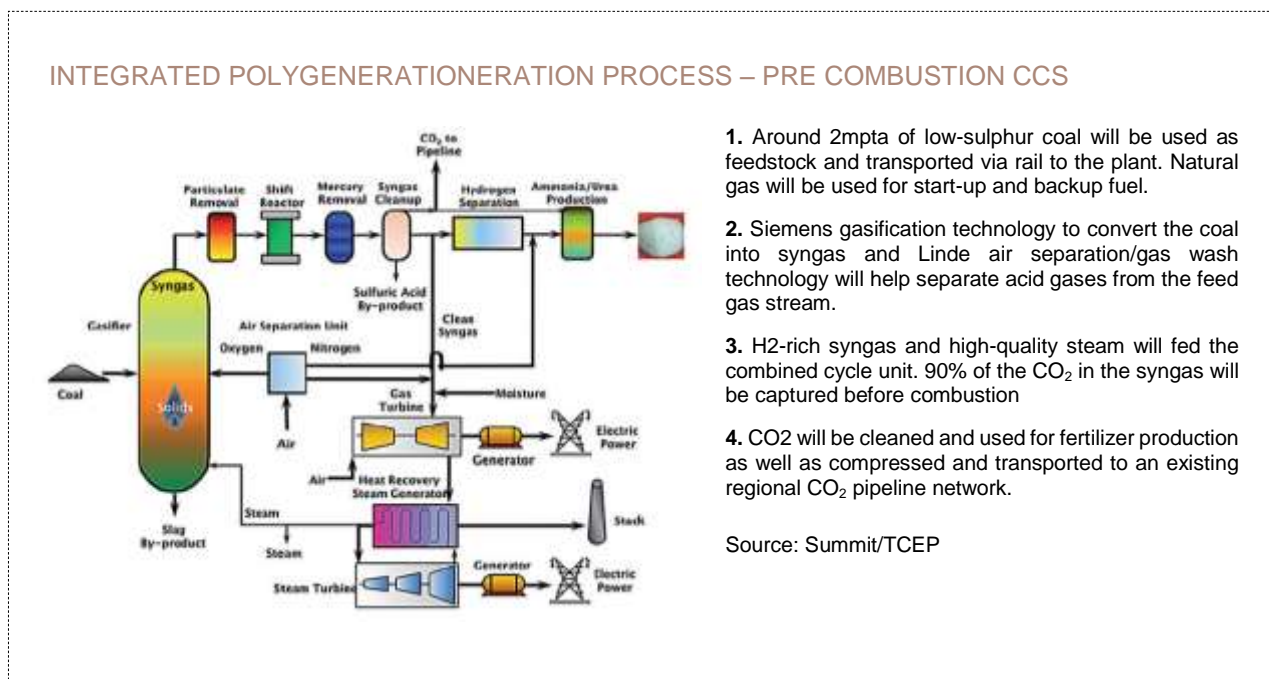
Diagram 18 – Schematic of the Texas Clean Energy Project Commercial Concept



Source: Summit/TCEP

In terms of product flows, around two thirds of the syngas will be used to generate 400MW of power, of which approximately 195MW will be sold to CPS Energy of San Antonio under a long term contract, with the remainder used in the gasification and fertiliser projects as well as for CO₂ compression. The water-gas shift and acid gas removal process in the gasifier (see below diagram) removes up to 90% (3mtpa) of the CO₂ that would be otherwise be emitted by the plant and most of this captured gas is sold for EOR operations in the west Texas Permian Basin, with a small amount (one sixth) used for the production of fertiliser (along with the remaining syngas).

Diagram 19 – Schematic of the Texas Clean Energy Project Process



In the context of the previous comments in this report, from a financing perspective, we can make the following general observations:

8.1.1 Key Positives:

- **Location:** The TCEP site (Penwell, Texas, 15 miles West of Odessa) appears to offer significant logistical advantages that facilitate the transportation and commercialisation of both feedstock and output products: adjacent rail line, electricity transmission line, natural gas and CO₂ pipelines and connection to a major interstate highway.
- **Multiple Revenue Streams:** The fact that the project produces a number of valuable commodity products in addition to just power diversifies risk. This includes CO₂, which represents 20% of expected revenues compared to a sequestration only project where it is a cost/liability rather than revenue earning products. Interestingly, power accounts for only 20% of expected total revenues, indicating the relative importance of the poly-gen concept
- **Revenue Certainty:** Given the nature of the products produced, the project has been able to enter into long term contracts for the sale of these products and by doing so is likely to have removed a large part of the commodity risk. This is crucial to bankability of the project.
- **Technology:** Gasification technology has been in use for many years in a wide range of applications as have turbines running on syngas. In addition, the combination has been proven to be financeable in Europe with three relatively large scale IGCC power projects having been successfully project financed in the mid to late 1990's¹⁴
- **Proven CO₂ Market:** Texas has a proven and established market for CO₂ for use in EOR and this sets both contractual and cost precedent for the sale of the gas on long term contracts. The project clearly benefits from CO₂ being an asset rather than a liability.

8.1.2 Key Challenges

- **Multiple Revenue Streams:** What is a benefit can also be a challenge in terms of the commercial structure of the deal and particularly in integration of the processes involved. One assumes that each of the supply contracts entered into by the company contain damages provisions for supply interruption which could magnify the financial impact of any outages in the gasifier or supply chain when compared to a standard power project or industrial facility.
- **Integration:** Whilst TCEP is seeking to integrate proven technology, it is generally the case that more components equate to more complexity. This could complicate the initial bankability of the project but will in any case be a key element of technical due diligence.
- **Sequestration?** To be viewed as a CCS project it will be necessary to demonstrate that the CO₂ (or a demonstrable proportion) stays in the reservoir following injection. Texas law, passed in 2009 to provide financial incentives to the first three coal-fired plants that capture at least 70% of their carbon, mandates that 99% of the sequestered CO₂ remain in the ground for the minimum of 1,000 years and that the three projects employ the University of Texas, Bureau of Economic Geology to ensure that it does.
- **First of a kind financing:** Whilst a number of aspects of the project are proven and have been financed, the combination in an integrated project represents a first of a kind for commercial financing. As such, the debt structures and documentation to be negotiated have no real precedent to follow in respect of the specific issues around integration and inter-dependency.

As mentioned before, the overreaching objective of TCEP is to demonstrate that CCS technologies can work on a commercial basis. However such demonstration requires a structure that is strong enough to attract investors and lenders ready to fully commit to the project. In the case of TCEP, and given the nature of the plant, both public and private players are expected to be involved in the financing of the project and financing remains the final challenge for the project before entering construction.

¹⁴ **Sarlux srl, Sardinia** – a 545MW IGCC project financed in 1996
ISAB Energia, Sicily – a 520MW IGCC project financed in 1996
Api Energia, Falconara – a 280MW IGCC project financed in 1997

All these projects benefited from the Italian CIP6 incentive tariff and used refinery residue from adjacent refineries as fuel

The project is expected to cost in excess of US\$3.0bn and to date, financing includes:

- **Shareholder Funding:** approximately \$60 million of development capital from a combination of strategic investors invested to date (including Linde, Siemens and Fluor);
- **Public Funds:** The U.S. Department of Energy (DOE) has made funding available to the project as follows:
 - \$350 million under Round 3 of the Clean Coal Power Initiative (CCPI) in December 2009, the largest contribution yet made under such initiative, the award included funds from the American Recovery and Reinvestment Act of 2009 designated for the demonstration of the commercial viability of CO₂ capture and sequestration;
 - \$100 million in additional CCPI funds were awarded to TCEP in 2010; and
 - In October 2011, the DOE issued a Record of Decision (ROD) allowing the project to proceed and spend federal funds beyond engineering and design studies.

The detailed financing plan for the project remains commercially confidential but having reviewed a number of financing options, TCEP is reported to have elected to select Sinopec Engineering Group as the EPC contractor for the gasification and chemical blocks of the project which opened the door to support from China's ChinaExim. It is our understanding that ChinaExim and associated Chinese banks will now provide all the required debt financing for the project. The involvement of Siemens as the EPC contractor, along with Selas Fluid Processing Corporation, for the gas turbine island, and other sub-contractors employed on the project could facilitate the participation of a number of other ECAs if required.

The current financing strategy for TCEP serves to illustrate the substantial benefit to be gained by targeting ECA/tied support through the strategic selection of equity partners and contractors for CCS projects. It is our view that the financing for the project could have been secured from the traditional project finance markets but commercially, it has to be assumed that the Sinopec-ChinaExim combination was commercially beneficial and reduced execution risk when compared to a more traditional financing.

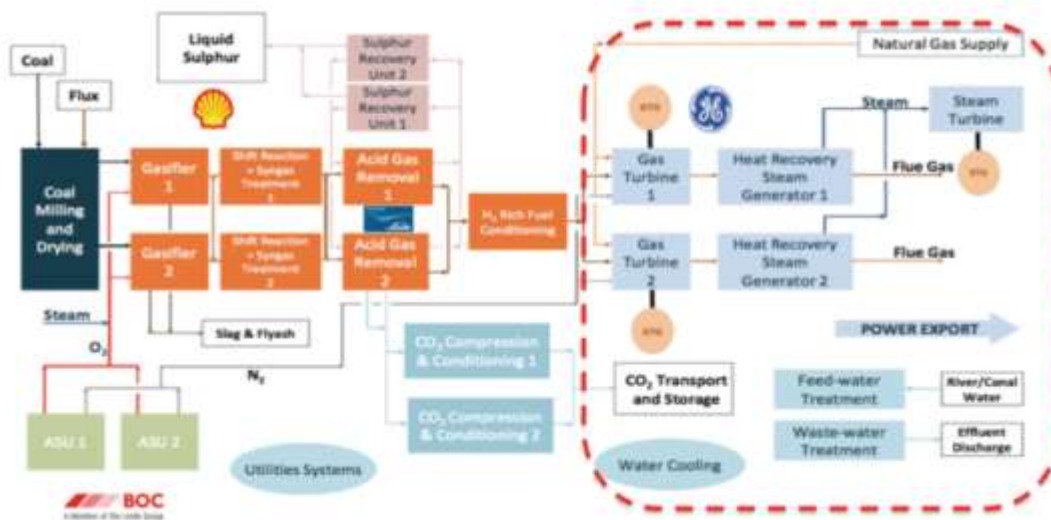
TCEP is currently scheduled to achieve financial close by 2014 and commence construction. Commercial operation is scheduled for 2017/8 but the project will begin sequestering carbon during start-up and testing in 2017.

8.2 Don Valley, UK

The Don Valley Power Project (DVPP) is a new build 920MW gross, 650MW net CCS power plant at Stainforth in Yorkshire, England. The project is being developed by 2Co Energy, a dedicated CCS development company based in the UK, Samsung C&T (Korea) and BOC Group. As with TCEP, DVPP is a pre-combustion project based on gasification technology, with the captured CO₂ being used for EOR from mature oil fields in the Central North Sea. Unlike TCEP though, DVPP is not a poly-gen project as power generation is the primary use of the syngas generated by the gasifier. Subsidiaries of 2Co will take responsibility for the IGCC and CO₂ EOR/storage, with CO₂ transportation provided by National Grid, the operator of the UK's existing natural gas transmission network.

When fully operational, the project will capture up to 5 million tonnes per annum of CO₂ which will be piped more than 300km to depleted oil fields to produce up to 150 million barrels of additional oil, leaving the CO₂ in permanently storage. 2Co is working with Talisman Energy, one of Canada's largest independent oil and gas companies, on two of its Central North Sea oil fields which it plans to use for EOR and CO₂ storage purposes. Apart from EOR, National Grid is also developing a potential secondary storage option in deep offshore saline formations that could be used by DVPP or other CCS projects under development in the region. The Yorkshire and Humber area contains a large concentration of power and industrial emitters and accounts for almost one fifth of the UK's CO₂ emissions so it also provides significant potential for the development of a major "CCS hub" to facilitate development of further projects in power and industrial applications.

A schematic illustration of the process proposed is outlined below:

Diagram 20 – Schematic of the Don Valley Project Commercial Structure

Source: Don Valley

The original Front End Engineering Design (FEED) was completed in 2009 and Section 36 (UK planning consent) was granted in the same year. Primary utility connections for electricity, gas and water have also been secured. A Value Assurance FEED (VAF) contract has been placed with Samsung Construction and Trading Corporation for a refresh on the FEED package, including refinement of costs and schedule. The aim of the VAF is to provide more accurate capital cost numbers, and will be followed by an EPC contract with Samsung. A similar exercise is being carried out with Linde in respect of the Air Separation Unit.

Total investment in DVPP is expected to be in excess of £4bn, including £3bn for the CCS plant site and £1bn for the offshore facilities. The intention is that the power generation/carbon capture facility and the storage/EOR part will be owned by separate subsidiaries of 2Co, and will be developed and funded separately. National Grid is expected to be responsible for constructing and funding the CO₂ pipeline and associated transportation infrastructure. It is anticipated that construction of the DVPP plant itself will take c. 36 months from FID, and initial commissioning and testing will take 6 to 9 months.

8.2.1 Key Positives:

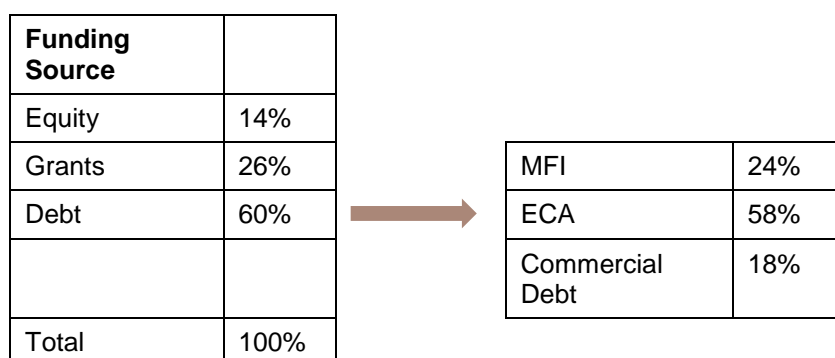
- **Location:** The project is located near Humberside, an area with one of the heaviest concentrations of CO₂ emission in Europe. Development of the project could, therefore, offer significant cost and logistical benefits for the wider CCS industry by facilitating economic development of an oversize pipeline and storage infrastructure for future projects in the area to share. The project location also enables the potential use of CO₂ for EOR, with the aggregation of several CO₂ sources to feed demand.
- **EOR Economics:** Depending on the commercial arrangements, the additional dimension of EOR provides the project with a direct or indirect potential benefit from the added value of oil recovery and effectively reduce the net subsidy needed by the project.
- **Technology:** The project is based on gasification technology, similar the TCEP project, and holds technology licences with leading suppliers (GE for gasifiers for example).
- **Policy / Regulatory Framework:** The UK CfD incentive scheme has the potential to provide significant long term support for CCS development, depending on the outcome of ongoing negotiations on contract terms and conditions, irrespective of whether the failure of the project to qualify for the upfront funding from the current CCS Commercialisation Competition.

8.2.2 Key Challenges

- **EOR Precedent:** There is little or no precedent for EOR operation offshore in the North Sea fields and whilst CO₂ based EOR appears to be feasible, the development and proving of EOR adds an additional layer of complexity in terms of integration and overall proving of the CCS technology chain. In contrast to the TCEP situation, EOR in the UK will be offshore rather than on shore.
- **Integration:** Whilst DVPP does not have the same challenges as TCEP in terms of integrating chemicals production, it does not have the benefit of an existing CO₂ transport and EOR industry to tap into. This means that CO₂ production and use have to be fully integrated as buffer storage and the ability to trade around a position may not immediately exist. To a certain extent this can be dealt with through the commercial arrangements.
- **Sequestration ?:** As with TCEP, to be viewed as a CCS project and earn CfD payments, the project will have to demonstrate that the CO₂ (or a demonstrable proportion) stays in the reservoir following injection.
- **Sponsorship:** As of today, DVPP is an SPV established for the sole purpose of developing the Don Valley project and is majority owned by a financial investor (TPG – the global private investment firm) rather than industrial backing. It is anticipated that this would be addressed during the development of the project as additional strategic partners join the project. Progress has been made with the introduction of contractors/suppliers Samsung C&T from Korea and BOC from the UK in 2012 for a total of 30% of the equity in the project, but as stated previously sponsor relationship is a crucial aspect of the financing equation.
- **Scale:** As currently proposed and leaving aside the efficiency and other rationale for the project size, the Don Valley project represents a significant financing challenge given the lack of precedent in the industry due to the scale of capital investment required. The implications of this are further discussed below.

It is anticipated that each component of the project (capture/power, transport and EOR/storage) will be structured and financed on a standalone basis with the interface between each governed by contractual arrangements. This being the case, for the purposes of this exercise we will focus on the capture & power plant and assume a project cost of GBP3bn. Based on published data from 2Co, the original financing plan can be summarised as follows:

Diagram 21 – Don Valley Project - Funding Structure



A key component of the financing plan is the 26% attributed to the government grant funding. The importance of this from a debt structuring perspective is that it can be treated as equity and thus improve the gearing from a funding perspective whilst substantially reducing the equity at risk from the sponsors.

In addition to the upfront funding, the project will also seek support through a long term Contract for Difference (CfD) agreement under the new UK market arrangements to subsidise the additional ongoing costs associated with CCS.

Looking at each component of the outline financing plan:

- **Debt Funding:** Of the approximately GBP1.8bn of debt funding assumed for the power and capture plant, only 18% is expected to come from the commercial non-recourse debt market. The remainder of the financing requirement is expected to come from ECA backed facilities (58%) associated with equipment supply packages and various strategic partners in the project, and from multi-laterals (24%). This debt financing plan is coherent in the context of other significant infrastructure projects.
- **Grants:** In terms of grant funding, the project applied for grant funding from the following sources with the current status summarised below:

Table 5 – Don Valley Grant Status

Source	Scheme	Current Status
European Union	European Energy Program for Recovery (EEPR) A €4bn programme established in 2009 to co-finance EU energy projects that would boost the economic recovery, increase the security of energy supply and contribute to the reduction of greenhouse gas emissions.	DVPP was awarded €180m of EEPR funding of which, €60m was shared with National Grid to fund feasibility studies and design for the transportation and storage part of the project.
European Union	New Entrant Reserve (NER) program A €1.5bn fund to support CCS and renewable projects in the EU funded from the sale of EU ETS certificates held in reserve by the EU	None of the 13 CCS projects who submitted first round applications, including DVPP, were successful in winning NER funding. A second round process is underway but it is understood that DVPP did not apply
UK Government	CCS Commercialisation Competition The GBP1bn of funding being made available by the UK government to one or more commercial scale projects to promote the commercialisation of CCS	DVPP is not one of the two short-listed projects for this funding

Looking at the current status of the financing plan, the failure to secure NER and UKCCS Competition funding has left an obvious funding gap. As the NER funding would have been allocated over an extended period on a 'per tonne of CO₂ sequestered' basis and potentially also netted off against the CfD payments to be received by the project, this could be compensated for by a higher CfD strike price. The failure to secure UKCCS Competition funding has a more immediate impact as this could have provided significant upfront funding and will now have to be replaced by additional debt and/or equity.

Whilst we have no direct knowledge of the revised financing plan or any other changes to the project, it is possible to look to the offshore wind sector for precedent financing structures and on this basis, an alternative financing plan may include the following elements:

Diagram 22 – Don Valley Project – Potential Revised Funding Structure

	Original Funding Plan		Hypothesised Revised Funding Plan	
	(GBP'000)	%	(GBP'000)	%
Equity	420	14%	1,200	40%
Grant Funding	780	26%		
Debt:				
MFIs	420	14%	432	14%
ECAs	1,050	35%	1,044	35%
Commercial Debt	330	11%	324	11%
Total	3,000	100%	3,000	100%
Debt to Equity		60:40		60:40

Total debt implied by the financing plan is GBP1.8bn and although only 11% of this is expected to come from commercial debt this is still a significant ask so there is limited scope for replacing lost grant with additional debt

One of the key changes to the financing plan is the increased level of sponsor equity commitment required. Potential lenders to the project are likely to demand a minimum level of equity of 40-50% to underpin the debt economics so they will look to shareholder equity to make up the gap left by the loss of grant funding rather than increasing debt with additional repayment through increased incentive payments over time. This is illustrated in the graphic in Section 6.2 where levels of equity required in offshore wind deals are only just now converging on 30% as financiers are becoming more confident with the sector. However, in comparison to wind, the capital to be funded for the Don Valley project as it stands is two to three times higher than the current precedent wind farm financings and this is in itself a challenge given previous comments on liquidity in the market and the novel nature of CCS.

The equity and debt challenge faced by the project are not insurmountable in our view but it adds an additional challenge to an already complex project and will, by necessity, lead to a higher strike price on the CfD. This in turn may require a revision of the project scope, possibly by phasing the development, to better facilitate funding of the project.

8.3 White Rose

White Rose is a 426MW coal-fired Oxy-Power plant located on the Drax power station site in Selby, North Yorkshire, UK. The project is to be designed to process 100% of the flue gas from the combustion process and capture 90% of the CO₂ in the flue gas stream. The project is sponsored by Alstom, Drax and BOC Group.

The project is also the “anchor project” for the proposed regional CO₂ transport & storage network (hub) being established in this area by National Grid Carbon. The Humber estuary region, in which the project is based, has one of the highest CO₂ emission levels in Europe due to a concentration of power and industrial facilities in the area. Through this network, captured CO₂ will be transported to, and permanently stored in, an off-shore saline aquifer formation. The pipeline & storage solution being built as part of the White Rose project is “over-sized to facilitate access of follow on projects in the region



Unlike some other pre and post combustion technologies where the capture occurs in dedicated chemical plants, the Oxy-Combustion process effectively facilitates captures the CO₂ within the boiler by combusting coal in an oxygen-rich environment with processing through a gas processing unit. The process is represented in the following schematic.



Key positives:

- **Location:** The Humber estuary has one of Europe’s largest concentrations of CO₂ emissions in Europe and is widely considered as a prime location for a hub development incorporating power, refinery and other industrial emitters
- **Sponsors:** The companies behind White Rose are all very significant corporate entities with a strong strategic rationale to develop a CCS project and very significant experience to bring to the project in terms of design and construction of the plant. They are joined by National Grid Carbon as the transport and storage operator who also has strong strategic rationale for the project.
- **Financing Credibility:** All of the sponsors are well known to the global finance community, have very strong relationships with major financial institutions through their corporate and project borrowing activities and can therefore call on relationship banks to support the development of the project.

- **Technology:** As indicated the capture technology is to a certain extent integrated within the combustion process, making the integration of the plant potentially simpler but also potentially facilitating flexible operation. It has also been proven on a smaller scale at a test facility in Germany over a number of years.
- **Strong Government Support:** The project has been selected as one of two projects to proceed with FEED under the UK Government CCS Commercialisation Competition and depending on the outcome of this FEED, could qualify for a significant capital grant from the GBP 1bn available under this competition. In addition, the project is now the only CCS project remaining in the European Union's "NER300" funding competition, which could also provide non-refundable financing for the project. The importance of this is illustrated below.
- **Revenue Certainty:** Under the UK Government's Electricity Market Reform process, clean energy projects will now be developed under a FiT CFD system under which they will agree a strike price (price per MWh of generation) required to recover their capital and operating costs with a return over the life of the contract. This has the potential to be a very secure and very financeable revenue stream, as well as conceivably having the flexibility to react to certain project events as a risk mitigation measure.

Key challenges:

- **Technology:** Whilst the testing of the technology and expertise of Alstom are positives, there is still the challenge of developing the technology to a full scale operating plant. This is one of the key elements of the FEED process and also reflects in the commercial structure of the project.
- **Integration:** The capture plant and transport and storage infrastructure have to work effectively in a coordinated fashion as there is no buffer store to even out gas flows. The storage solution has to also accommodate flow rates, fluctuations and characteristics of the gas being stored.
- **First of a kind financing:** This is clearly a first of a kind financing in terms of technology and the underlying support regime (CfD mechanism). However, the fundamental basis of the plant is a power plant and it is being executed in the UK market; both power and UK market are very familiar to the financing community given the large number of transactions that have been executed in the market.

As indicated above, one of the key positives of this deal (and the Peterhead transaction also shortlisted in the UK competition) is that it is being executed in a very supportive market, where the CfD mechanism could facilitate development of this type of first of a kind technology and respond to some of the specific risks associated with the projects. In addition to the operating phase support of the CfD, the regime also provides for up-front capital cost support through the GBP 1bn of grant funding potentially being made available to White Rose and/or the Peterhead project. Without disclosing details of the White Rose financing plan, the potential importance of the capital grant to the commercial funding of the project is evident. In effect, it brings the following benefits:

- If structured correctly, the grant can be considered as equity as far as the commercial lenders are concerned. This effectively leads to more conservative gearing in the financing plan and facilitates the commercial financing of the deal; and
- The commitment of significant grant funding to the project from the government also provides a strong message of support to the transaction. This is again a positive point for the potential commercial lenders.

It is interesting that White Rose is one of a small number of projects that have engaged in detail with the finance community, including multilaterals and ECAs, and the response has been very encouraging. Part of the positive feedback centres on the above points and White Rose are confident that they will be able to create a commercially financeable project in cooperation with National Grid and the UK Government and White Rose could be one of the first projects to be developed on a traditional project finance basis.

8.4 Key Findings

The overriding observation from looking at these and other projects is that there is no "standard" CCS project. The diversity of applications, technology, locations and specific support schemes makes the assessment of financing options complex and challenging. However, some common themes are evident in the case studies presented even if the underlying projects are very different:

- Assessment and allocation of risk is essential to make the projects bankable – primarily this relates to technology scale-up (CCS) and integration risk;
- Given that capital costs of the early CCS projects are likely to be in the order of US\$3-5bn (possibly less for retrofit), provision of financial support is essential to the underlying economics – whether in the form of grant funding, operating subsidy or both, subsidy is essential for early CCS as they are not fundamentally economic in the current market structures;
- Whilst obvious to say, up-front grant funding has significant benefit in facilitating an external debt funding for CCS as it substantially increases the effective equity in the project for leverage purposes and more importantly, reduces the debt required;
- It is equally clear that project viability is hugely improved where additional revenues are available although this is at the cost of complexity which could impact financing;
- External commercial debt financing and other financial support is available for CCS, albeit that at this stage we have not seen financial close on a commercial debt package for a large scale CCS project although extensive discussions are now taking place on a number of projects around the world;
- Based on our experience, it would be reasonable to expect each bank to commit to maximum tickets of US\$75-100m for early projects, meaning that 10-15 lenders are likely to be required to finance a single project even with the additional support of multilaterals;
- Debt financing is likely to start from a relatively conservative gearing (50:50), but again based on experience should evolve towards 70:30 debt to equity ratios as the industry becomes established over a 3-5 year time horizon and assuming a flow of CCS transactions;
- In order to attract the required financing for early projects, capital structures need to be conservative, implying significant sponsor equity commitment;
- Location is important, both in terms of a supportive jurisdiction but crucially in relation to the physical location. TCEP is located adjacent to CO₂ infrastructure feeding an existing EOR demand. Don Valley and White Rose are located in an area with one of the highest CO₂ emissions in Europe, providing opportunities for aggregation and cost reduction. It is also relatively close to the North Sea, allowing for access to significant off-shore storage and potentially, EOR. Projects with more challenging locations have fallen by the wayside;
- Even apparently strong projects in the context of the industry, as illustrated by Don Valley and TCEP, require very long development lead times and significant development funding but success is far from assured and this has caused financial institutions to take a wait and see approach; and
- It is likely that some risks cannot be financed, at least for early projects, and storage liability may be an example of this.

9. Conclusion

Preparing this report presented some unique challenges given that we are evaluating financing prospects for an industry that does not really exist yet, in markets where support and policy mechanisms are still evolving and for projects where in many cases, structures and risk allocation is still being defined. Having said this, the emergence of a number of credible projects combined with financial support for commercial “demonstration” projects to prove technology and contractual structures has significantly raised the awareness in the finance community of CCS as a business opportunity.

It became evident during the research for this report that whilst there is increasing interest from financial institutions in CCS and awareness of the potential business opportunity, the widely held perception is still that the industry is in its infancy with substantial issues around competitiveness and risk (technology, integration and storage in particular). As with any nascent industry, the differing approach to the development of projects (poly-gen or CCS, pre or post combustion, storage or EOR, full chain or component etc) also makes it complex to view the financing prospects in the round. On the face of it, a poly-gen project with appropriate support or a project with significant capital grant funding and on-going operating subsidy should be an attractive financing proposition but as yet, we have not seen a full commercial bank financing closed for a CCS project. Closing this first commercial project financing is absolutely crucial in turning the evident interest of the financial community in CCS into the substantial amount of committed funding required to build out the sector. In short, confidence from successful delivery of the first projects will be crucial to enhance the financing prospects of subsequent projects – success breeds success

However, it is equally true that failure of early projects could have a very negative impact on future financing of the industry, particularly if financial institutions have to write off debt as a result. Confidence is a fragile commodity in the finance world and one common theme during our discussions for this report focused on

why so many of the supposedly promising projects with industry leading sponsors have fallen by the wayside over the past several years as they approach final investment decision. This has made many financial institutions sceptical of the ability to execute commercial scale CCS so they have been reluctant to dedicate significant resources to develop their understanding of the sector before seeing some tangible success. Development of financing structures will therefore depend on a smaller group of financing “pioneers” willing to take the risk that one project is the genesis of a global industry. From our discussions we believe that there are enough of these institutions in the market to develop financing structures and enough capacity to finance early projects but institutions are waiting for the right project in the right environment to undertake this exercise. To reiterate the previous comments, the key to placing a successful financing is early engagement, buy-in from financial institutions, maintaining momentum and innovative structuring within a supportive policy and regulatory framework.

Based on the engagement and bank market sounding for a number of projects it is our view that straight debt financing as often seen in the utilities sector is unlikely to be the basis for financing early projects. Our expectation is that more complex multi-source financing will be required in order to close commercial scale projects. A combination of ECA support, multilateral funding and commercial debt is likely, leading projects to very carefully select equity and other partners for the projects in order to optimise financability and financing terms. This is evident in the proposed financing approach of Don Valley and even more so in the reported selection by TCEP of Chinese partners in order to access Chinese financing for their project. We are aware of at least one other advanced CCS development where discussions with equity partners and selection of construction contractors and equipment suppliers is being run in parallel with discussions with ECAs, multilaterals and project finance banks, again to optimise financing prospects. This inclusive structuring approach appears to be the likely model for a successful commercially financed CCS project as long as all parties are willing to invest in the process and take a pragmatic approach to risk allocation and structuring.

We have used the example of the development of the offshore wind business as a proxy for how financing of CCS may evolve as in many respects this industry has faced and overcome many of the hurdles to be faced by CCS. Whilst not yet fully mainstream, offshore wind is still heavily subsidised, involves the application of new technology in an often un-hospitable environment and does require huge capital investment on a project-by-project basis. None the less, the sector is increasingly able to raise non-recourse debt for amounts exceeding US\$1bn for each project and US\$4-5bn per year. Commitments are also increasing year-on-year. We believe that CCS can similarly access the debt markets once concepts have been proven and the risk matrix has been established. Given the cost reduction potential between the FOAK and n^{th} of a kind, development of financing capacity could also be significantly more rapid than for offshore wind. One of the other lessons to be learned from offshore wind and other sectors is the need for innovative integration of all available liquidity sources to quickly and efficiently build the funding base.

Our overall conclusion is that despite the lack of tangible examples of financing in the sector, there is enough interest and enthusiasm for CCS across the spectrum of available financing sources to kick start the industry despite the obvious challenges. The key is to create and maintain momentum, and drive forward an industry that is widely viewed as a key part of the emissions reduction arsenal. In order to do this it is essential to engage with, involve and work with the financing community (in the broadest sense) to deliver the early projects and in doing so, financing for subsequent projects should become more readily available and more competitive.

To improve availability of financing, the CCS industry needs to demonstrate tangible success to create confidence in the financing community.

“We need to start planning for success and not failure”.

Lewis Gillies, CEO - Don Valley Power Project

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Glossary

CCS	Carbon Capture & Storage (Sequestration)
ChinaExim	China Export Import Bank
CfD	Contract for Difference
CCPI	Clean Coal Power Initiative
CCUS	Carbon Capture, Use & Storage
DCM	Debt Capital Markets
DD	Due Diligence
DOE	Department of Energy
DRI	Direct Reduced Iron
DSCR	Debt Service Cover Ratio (ratio of debt service due to cash flow available to meet this)
DVPP	Don Valley Power Project
EBRD	European Bank for Reconstruction & Development
ECA	Export Credit Agency
EIB	European Investment Bank
EEPR	European Energy for Recovery Programme
EOR	Enhanced Oil Recovery
E&Y	Ernst & Young
EPC	Engineering, Procurement & Construction
FEED	Front End Engineering & Design
FIT	Feed In Tariff
FOAK	First of a Kind
GFC	Global Financial Crisis
GWh	Giga Watt Hour
IPP	Independent Power Project
IWPP	Integrated Water & Power Project
LSIP	Large Scale Integrated Project
NER300	Funding scheme based on sale of 300m ETS carbon certificates by the EU
N th of a kind	Indicative of later more proven projects in a development series
O&G	Oil & Gas
PFI	Public Finance Institution
PIM	Preliminary Information Memorandum (Information document provided to financiers)
Poly-Gen	Projects generating more than one saleable output
PPA	Power Purchase Agreement
SG	Societe Generale
TCEP	Texas Clean Energy Project

Diagrams

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Societe Generale Corporate & Investment Bank has been one of the leading financing institutions in the CCS arena over the past four years and has been instrumental to representing the finance community in the development of policy and regulation in relation to the CCS sector. The bank is (or has) acted as Financial Advisor to a number of the world's largest CCS projects and is currently advising White Rose, one of the two projects selected for FEED funding by the UK Government under the CCS Commercialisation Competition, and Hydrogen Energy California in the USA.