# ICF DECC Annual review reporting template

**Project Title: International CCS Capacity Building Programme**

**Review date: July 2014**

| | |
|---|---|
| **Project Location:** | Global [in particular, China, Indonesia, South Africa and Mexico] |
| **Project Timescale:** | December 2012 to December 2018 |
| **Current Reporting Period:** | December 2012 to March 2014 |
| **Funding: (ICF Funding and possibly other sources)** | £60 million from the International Climate Fund |
| **Project website (if available):** | https://www.gov.uk/government/case-studies/international-carbon-capture-and-storage-capacity-building |
| **Project leader's name:** | Abu Zaki |

**Review Summary:**

| **What are the key messages from this Review?** |
|---|
| Overall, the CCS Programme outputs have met expectation. Good progress has been made in achieving all project specific indicators, with some areas exceeded expectations. In particular, we have exceeded in the following areas:<br><br>• ICF finance has enabled the World Bank and ADB to develop four pilot and demonstration projects in China, Indonesia, South Africa and Mexico, against a target of two pilot projects.<br>• A full chain CCS demonstration project is being developed in China, with $11 million provisionally allocated from the ADB CCS Trust Fund for this project.<br>• A pilot storage project in Indonesia has been developed, in collaboration with Japan International Cooperation Agency and Pertamina (a state-owned national oil and gas company). We have provisionally allocated $12 million from the ADB CCS Trust Fund for this project.<br>• Finances are in place to carry out the Pilot CO2 Storage Project in South Africa in 2017. This project is estimated to cost $50 million, with $25-$27 million to be funded from the World Bank CCS Trust Fund.<br>• Mexico has been identified as a key target country for the World Bank, and a capture pilot project is being developed. |

Key messages from this review:

- Currently we are on track to achieve or exceed most of the project specific indicators.

- The ICF finance, through the World Bank and ADB, is supporting pilot and demonstration projects in emerging economies, in line with our objectives. The pipeline of projects that is being developed has the potential to be transformational, and once implemented should show that CCS is a viable option for emerging economies.

- The ICF finance has enabled the World Bank and ADB to raise ambition and develop pilot and demonstration projects in ICF priority countries. However, there is a significant risk that delay could occur during the implementation phase. We will work with the World Bank and ADB to review these projects at every Steering Committee meetings to ensure we identify risks early and take the necessary actions to ensure these projects go ahead as planned.

- Political buy-in from host governments is essential to ensure the success of pilot and demonstration projects. This is why we are developing a strategic partnership with host governments, through working in partnership with the World Bank, ADB, the Global CCS Institute, FCO and DFID country offices, and other donors to increase collaboration on development of CCS technologies. We are also working with the ADB to set up three CCS centres (two in China and one in Indonesia) to increase our collaboration with the China. Funding channelled through the World Bank is being used to set up a CCS centre in Mexico, similar to the one which operates in South Africa.

- We have seen a positive change towards willingness of emerging economies to develop CCS demonstration projects. For example, the Chinese Government has given the green light to develop a pipeline of CCS projects, including to those supported by the ICF funding through the ADB CCS Trust Fund.

Key recommendations from the annual review include:

- Delivery partners should take steps to reduce the risk of delay in implementation of CCS pilot and demonstration projects. It is recommended that both the World Bank and ADB look for opportunities to accelerate their internal approval processes and start the implementation phase of the CCS projects.

- World Bank should explore fast-tracking the approval and development of the planned capture plant for the Phase II of the Mexico project on a natural gas-fired generating station, while ensuring proper due diligence, including compliance with environmental safeguards.

- Where feasible and relevant, ADB and World Bank projects should analyse if the chosen approach to promoting CCS in the host country is the most cost-effective, including how CCS could fit into the long term strategy for reducing emissions in the power sector.

- The World Bank and ADB should consider how to engage with counterparts to accelerate the timescale for implementing the pilot storage projects in South Africa and Indonesia, respectively.

Further details of how the World Bank and ADB will take forward these recommendations are set out in Section A.

***Legend on scoring***

| **Description** | **Scale** |
|---|---|
| Outputs substantially exceeded expectation | A++ |
| Outputs moderately exceeded expectation | A+ |
| Outputs met expectation | A |
| Outputs moderately did not meet expectation | B |
| Outputs substantially did not meet expectation | C |

**Introduction and Context**

**What support is the UK providing?**

The UK has committed £60 million of finance from the International Climate Fund (ICF) to trust funds operated by the World Bank and Asian Development Bank (ADB) to support developing countries to develop both the technical and institutional knowledge necessary to enable the deployment of Carbon Capture and Storage (CCS) technologies. The ICF finance will support CCS capacity building through pilot and demonstration projects, with the aim of demonstrating the technology and reducing the cost of the technology application across the CCS chain. In particular, we will fund the incremental financing required for CCS planning & pre-investment, capital costs for CCS units and components, and CCS related post-completion & operation activities.

The intervention uses a mix of RDel (Resource) and CDel (Capital) finance where CDel spend is required to enable the purchase of capital assets associated with pre-commercial demonstration activities. Funding will be paid on the following timeline and be drawn from DECC's ICF allocation:

| | DECC Spend | | DECC Spend | |
|---|---|---|---|---|
| Recipient | 2012/13 (£m) | % CDEL | 2013/14 (£m) | % CDEL |
| World Bank | 14.9 | 67% | 10.1 | 0% |
| Asian Development Bank | 35 | 43% | | |

The ICF finance is channelled towards a range of capacity building activities in China, Indonesia, South Africa and Mexico. These emerging economies are heavily reliant on fossil fuels and the evidence indicates that CCS will be needed for their medium-term low carbon emission strategies to be cost effective (and therefore more likely to happen). Given these economies rank highly in total emissions globally, significant emissions reductions from CCS in these emerging economies would have an impact on global emissions reductions.

The ICF funding will help raise the level of understanding of CCS within these countries, leading to the establishment of necessary policy frameworks, technical know-how and incentive structures to support CCS demonstration and ultimately accelerate the deployment of CCS. The World Bank and ADB CCS Trust Funds will support capacity building through pilot and demonstration activities. In particular:

- Preparation and implementation of full chain integrated CCS pilot and demonstration projects in developing countries that are part of low carbon development strategies and plans endorsed by respective in-country authorities to facilitate the fulfilment of their share in global climate change mitigation efforts. CCS Trust Funds will support incremental financing required for CCS planning & pre-investment, capital costs for CCS units and components, and CCS related post-completion & operation activities.

- Development of geological site characterisation intended for integrated full scale CCS projects, both at the pilot and commercial demonstration scales to maximise knowledge on

both near-term and future storage capacities.

- Pilot and demonstration activities aimed at reducing the cost of the technology application across the CCS chain (excluding retrofit activities not associated with CCS).

**What is the context in which UK support is provided and why is UK support required?**

There is a very strong strategic case for using the ICF to support CCS capacity building. The widespread deployment of CCS technologies in developing countries in the medium-term is of critical importance and essential if we are to avoid dangerous climate change. The International Energy Agency (IEA) has estimated that on a least cost basis, CCS will be required to deliver 14% of the CO2 savings required by 2050 to enable us to keep global temperature rise at or below 2 °C and so avoid the most damaging effects of climate change. A total cumulative mass of approximately 120 $GtCO_2$ would need to be captured and stored between 2015 and 2050. Of this total, 70% of stored CO2 by 2050 would need to be from applications in non-OECD countries. To achieve this will require the construction by 2050 of approximately 3,400 plants worldwide with over 2,000 of these being built in non-OECD countries.

In order to address this issue, the Asian Development Bank (ADB) have assessed that $5bn of public finance is required to stimulate and incentivise CCS demonstration in emerging economies. An ADB paper, presented at the Carbon Sequestration Leadership Forum[1] (CSLF) calls for the creation of a CCS Demonstration Fund at a scale large enough ($5 billion) to support multiple projects over a period of time (at least 10 years) in fossil fuel-based emerging economies. The UK has committed £60m to support CCS capacity building in developing countries. This pledge will go towards the global commitment made by international governments through the Clean Energy Ministerial - Carbon Capture, Use and Storage Action Group[2] to allocate $200m internationally to accelerate the deployment of CCS in the near term. The provision of UK finance will not only cover the costs arising from a small number of activities that are need to be undertaken prior to any commercial demonstration in a developing country but also leverage others to provide further finance to support this important objective.

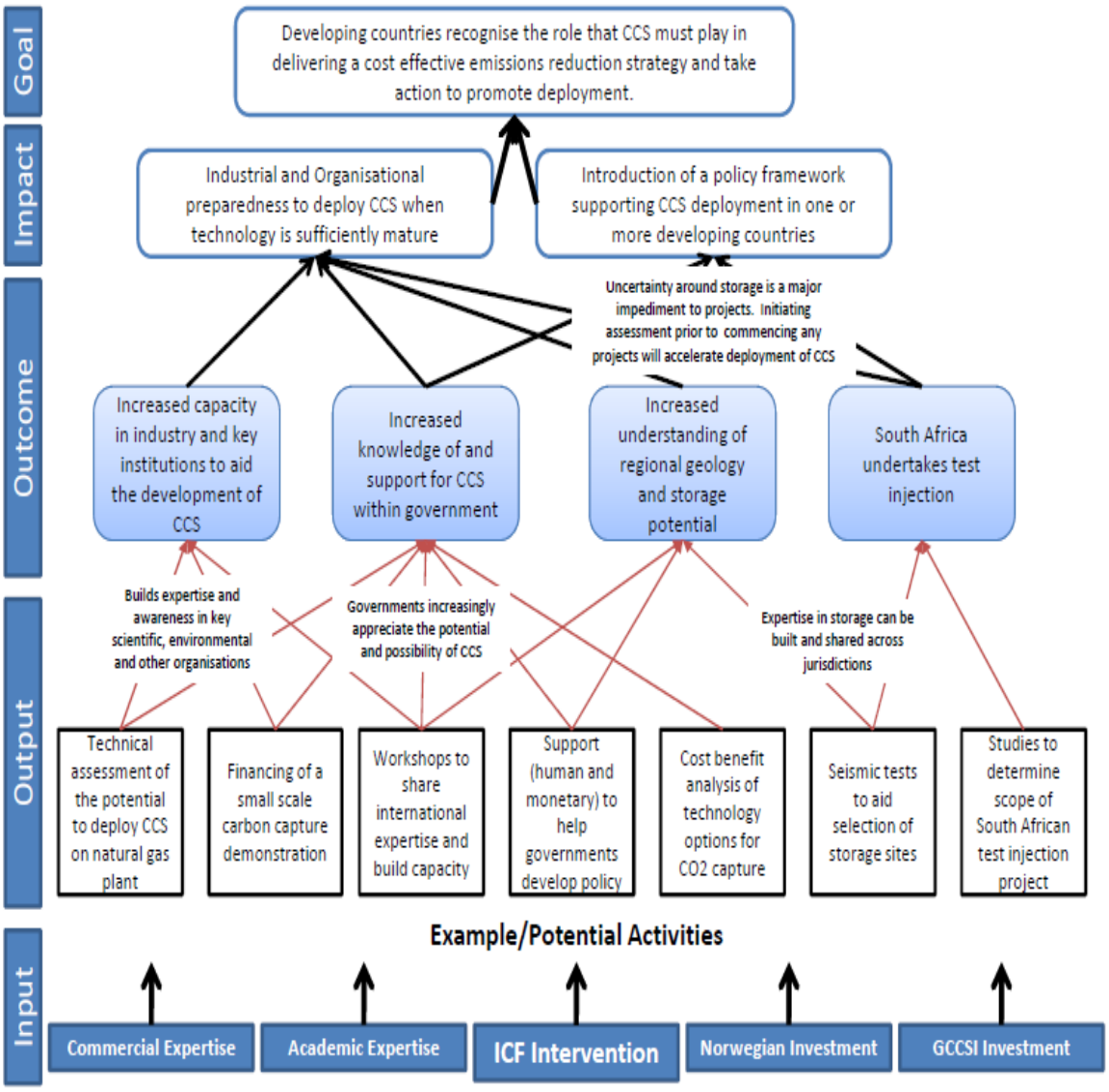
At present there are two CCS related projects in operation in developing countries: one large-scale CCS project associated with an Enhanced Oil Recovery (EOR) operating in Brazil; and a storage project in Algeria, which has been injecting into a saline aquifer since 2004 (injection phase recently ended). There are two further large-scale CCS projects associated with EOR in the construction phase in United Arab Emirates and Saudi Arabia respectively. This demonstrates the interest of developing CCS technology in developing countries. However, currently there are no large-scale demonstration projects in operation in the UK countries of focus where ICF funding is targeted – i.e. China, Indonesia, South Africa and Mexico.

[1] A dedicated Ministerial level forum established to promote the demonstration and ultimate deployment of CCS technologies representing 24 countries and the European Union

[2] The Carbon Capture, Use and Storage (CCUS) Action Group was established by the governments of Australia and the United Kingdom in 2010. It brings together governments, institutions, and industry to facilitate political leadership and provide recommendations to the Clean Energy Ministerial (CEM) on concrete, near-term actions to accelerate the global deployment of CCS.

**What are the expected results?**

**Theory of Change:** setting out how it is anticipated that ICF finance will deliver progress toward the intervention goal




**What are the expected results**

The allocation of finance from the ICF to support capacity building activities in developing countries will facilitate a number of activities to develop human and institutional capacity and create an enabling environment for CCS to be taken forward in key countries. Financial support is being channelled towards a range of projects in China, Indonesia, South Africa and Mexico with the aim of building on government initiatives to ensure that sufficient political support is created to pave the way for full scale demonstration and ultimately the deployment of CCS.

The specific interventions have been identified with partner organisations and are consistent with the objectives of the host country governments:

- In China, financial support will go towards demonstration activities in order to develop further knowledge and expertise within both industry and government partners. Pilot and demonstration projects will aim to test different technologies, including a full chain pilot project. The relevant Chinese Ministries support the work programme being developed by the ADB, but projects will not go ahead due to substantial regulatory and financial uncertainties, unless supported by grant assistance complemented with external expertise. The projects that will be delivered in China will establish essential in-country experiences in the realisation of a full-chain project and provide evidence of the various options for CCS deployment as well as some of the potential means in which the economic losses associated particularly with CO2 capture and transport can be reduced. They will further support the establishment of management and operation standards, which are currently lacking and thereby hampering CCS deployment.

- In South Africa, the government sponsored South African Centre for Carbon Capture and Storage (SACCCS) has developed a roadmap toward the first commercial demonstration of the technology. The next milestone is to plan and carry out a Pilot CO2 Storage Project and CO2 pilot capture project, a critical stage in determining the viability of CCS in the country. UK financing via the World Bank CCS Trust Fund would support this project.

- The ADB study on regional CCS identified the Indonesia gas sector has high potential for CCS. The gas processing industry in Indonesia provides a large number of low cost opportunities to demonstrate the potential application of CO2 capture and utilisation technologies. As the production is declining in the oil fields, the government of Indonesia is also interested in enhanced oil recovery (EOR) in the near future. The ADB is working with Indonesian partner organisations and Japan International Cooperation Agency (JICA) to develop a pilot CO2 capture project at a gas processing plant in Central Java. The project is expected to provide standard operating procedures for future CCS projects in the gas sector in Indonesia.

- In Mexico, the World Bank is working with the Government to implement its CCS Roadmap, establish a CCS Centre and support a comprehensive range of activities, including legal and regulatory developments, public engagement, and support for a pilot-scale capture project. The pilot-scale project will provide technical know-how to facilitate the translation to a demonstration scale project.

As a consequence of the proposed interventions, the capacity of industrial actors in the various target countries to take forward CCS demonstrations will be increased. At the same time, it is anticipated that the level of technical understanding of CCS in the four target governments will be raised and the storage potential of each country will be better understood. It is anticipated that this will feed into the establishment of political support and then necessary policy frameworks and incentive structures to support CCS demonstration and ultimately accelerate the deployment of CCS. This is set out in the Theory of Change (See page 5).

**Achievements to date**

In December 2012, DECC Ministers approved the disbursement of £35 million to the Asian Development Bank and £25 million to the World Bank to support their respective dedicated CCS Trust Funds for international CCS capacity building projects.

In December 2012, DECC signed MoUs with the World Bank and ADB respectively.

In March 2013, we agreed key provisions that required collective agreement with delivery partners and other donors at Steering Committee meetings, including key provisions on ensuring CCS Trust Funds are not used to support lending for coal-fired power plants. We also secured agreement from the World Bank and ADB to fund at least two evaluations, to be funded from their respective Trust Funds.

In March 2013, we agreed with the delivery partners that the primary aim of the CCS Trust Funds is to develop pilot and demonstration projects in China, Indonesia and South Africa. In June 2013, we have agreed with the World Bank to add Mexico as a key target country and fund a pilot project.

The ICF finance has enabled the World Bank and ADB to develop four pilot and demonstration projects in China, Indonesia, South Africa and Mexico, against a target of two pilot projects, including a full chain CCS demonstration project in China.

In September 2013, the Secretary of State for Energy and Climate Change has announced funding of $11 million for a full chain CCS project in China, and setting up of three CCS Centres (two in China and one in Indonesia).

A pilot storage project in Indonesia has been developed. In 2013, ADB provided a small-scale capacity development technical assistance (Stage 1) of $225,000 to conduct a feasibility-level analysis for a pilot storage project to inject CO2 in to a saline aquifer formation at a gas processing plant in the Gundih gas field in Central Java, Indonesia. In March 2014, we have provisionally allocated $12 million from the ADB CCS Trust Fund Phase II (test injection) of this project.

In September 2013, the ADB published a report on the *Potential for Carbon Capture and Storage in Southeast Asia*, which focused on an assessment of the CCS potential in Thailand, Vietnam, Indonesia and the Philippines. It contains inventories of CO2 emission sources, estimates of overall storage potential, and an analysis of existing policy, legal, and regulatory frameworks with a view toward supporting future CCS operations.

In February 2014, the World Bank in partnership with the South African Centre for CCS finalised funding needed to carry out the Pilot CO2 Storage project in South Africa in 2017. This project is estimated to cost $50 million, with $25-$27 million to be funded from the World Bank CCS Trust Fund.

The ADB has funded five workshops – three in China in April 2013, October 2013, and January 2014; and two in Indonesia in November 2013 and March 2014. The World Bank has funded two public engagement workshops in South Africa in 2013.

The UK is developing a strategic partnership with host governments, through working in partnership with the World Bank, ADB, the Global CCS Institute, FCO and DFID country offices, and other donors to increase collaboration on development of CCS technologies. We are also working with the ADB to set up three CCS centres (two in China and one in Indonesia) to increase our collaboration with the Chinese Government.

Overall, the ICF finance has enabled the World Bank and ADB to raise ambition and develop pilot and demonstration projects, which should demonstrate the potential and viability of CCS technology in developing countries.

**Table 1: World Bank CCS Work Programme**

| Project | Funding allocated from the CCS Trust Fund | Funding allocated by the World Bank | Funding allocated by other donors | Funding allocated by host government and/or companies |
|---|---|---|---|---|
| South Africa | Phase I – $1.35 million<br><br>Phase II – $25-27 million | $400,000 | $5 million (Norway) | $20 million (South African Department of Energy) |
| Mexico | Phase I – $1.3 million<br><br>Phase II – $12 million | $200,000 | | $10 million (tentatively, not confirmed yet) |

In addition to the pilot and demonstration projects set out in table 1, the World Bank is also funding CCS capacity building projects in nine countries (South Africa, Mexico, China, Indonesia, Botswana, Kosovo, Egypt, Jordan and Maghreb), with $8.3 million has been allocated for these projects.

**Table 2: ADB CCS Work Programme**

| Project | Funding allocated from the CCS Trust Fund | Funding allocated by the ADB | Funding allocated by other donors | Funding allocated by host government and/or companies |
|---|---|---|---|---|
| China | $11 million | | | $9 million |
| Indonesia | Stage 1 – $0.225 for a small scale Technical Assistance for a surface facility feasibility study (2013)<br><br>Stage 2 – $12 | | $5 million (Japan International Cooperation Agency) to be spread across feasibility studies and test injection (2013 onwards) | |

| | | | | |
|---|---|---|---|---|
| | million for detail design, facility construction and test injection (2015, planned) | | | |

In addition to the pilot and demonstration projects set out in table 2, the ADB is also funding nine CCS Technical Assistance projects, including in ICF priority countries such as China and Indonesia. A combined funding of $10.5m has been committed for these projects.

**Section A: Detailed Output Scoring**

Output 1: Increased capacity in industry and key institutions to aid the development of CCS

**Output 1.1: No. of small-scale demonstration projects established in developing countries**

**Output 1.1 score and performance description:** A, Outputs met expectation

**Progress against expected results:** During the development of the business case, it was envisaged that two small-scale pilot projects will be established in South Africa and Indonesia, as set out in the log frame (See Annex A). However, the significant ICF finance has enabled the World Bank and ADB to develop four pilot and demonstration projects in China, Indonesia, South Africa and Mexico, as set out below. The log frame will be revised by the end of this year to reflect the raised ambition of both the World Bank and ADB's CCS programme.

If all four CCS pilot projects go ahead as planned then we would exceed against this indicator. However, there is a significant risk that delay could occur during the implementation phase. At this stage we do not have certainty that these projects will happen until both the World Bank and ADB approve funding for these projects. This is taken on board in our assessment for awarding a score of A (Output met expectation). We will work with the World Bank and ADB to review these projects at every Steering Committee meetings to ensure we identify risks early and take the necessary actions to ensure these projects go ahead as planned.

**China:** GreenGen project in Tianjin. The UK has provisionally agreed funding of $11m from the ADB CCS Trust Fund to fund the construction of the CO2 capture plant. This is a pilot-scale full chain CCS demonstration project. The key components of the project are: i) construction of a CO2 capture plant with the capacity to capture up to 100,000 tonnes of CO2 per year, when fully operational; ii) transportation to Dagang oilfield; iii) partial utilisation of the captured CO2 for pilot-testing of CO2-EOR (Enhanced Oil Recovery); and iv) partial injection of CO2 in a depleted oil well for pilot-testing geosequestration of CO2. The pilot testing of CO2-EOR and CO2 storage will be conducted in steps: in the 1st step, a small amount of CO2 – between 3,000 tonnes to 5,000 tonnes – will be injected into each of the identified sites; in the 2nd step between 30,000 tonnes to 50,000 tonnes of CO2 will be injected.

The project development is well advanced: technical planning, cost estimates and implementation

strategy for the project are in the process of being completed; project sites have been identified; and the environmental impact assessment has been submitted to the Tianjin environmental bureau for approval. Construction of the CO2 capture plant is scheduled to start in July 2014, and to be completed by Q1, 2015.

ADB is working with the Huaneng Group (one of the five largest state-owned electric utility enterprises in China), and cooperating with the China National Petroleum Corporation to implement the project.

**Indonesia:** In 2013, ADB provided a small-scale capacity development technical assistance (Stage 1) of $225,000 to conduct a feasibility-level analysis for a pilot storage project to inject CO2 in to a saline aquifer formation at a gas processing plant in the Gundih gas field in Central Java, Indonesia. The ADB funding is used for the following activities: (i) develop preliminary engineering design and cost estimates for transport infrastructure, surface facilities, and test injection infrastructure, (ii) analyse financial viability, and (iii) review legal and regulatory issues related to CCS pilots. Stage 1 is expected to be finalized in 2014. These activities are undertaken in collaboration with a Japan International Cooperation Agency (JICA) project on sub-surface studies and CO2 monitoring of the pilot project.

ADB is currently working with JICA and Pertamina (a state-owned national oil and gas company) to develop Stage 2 of the programme. In Stage 2, all parties will support a CCS pilot project, including construction of surface facilities, test injection and CO2 monitoring. The UK has provisionally agreed to allocate $12m from the ADB CCS Trust Fund for this pilot storage project. JICA in collaboration with Japan Science and Technology Agency have agreed to make available up to $5 million in grant financing for sub-surface analyses and CO2 monitoring activities. Stage 2 will envision injecting about 10,000 tonnes of CO2 over a one-year period.

It is expected that the Government of Norway will provide a parallel co-financing to the Institute of Technology, Bandung (ITB), which is the leading Indonesian research institution in the pilot project, to undertake additional monitoring activities in Stage2.

**South Africa:** South Africa is actively engaged in CCS deployment. In South Africa, the government sponsored South African Centre for CCS (SACCCS) has developed a roadmap toward the first commercial demonstration of the technology. The next milestone is to plan and carry out a CO2 test pilot storage project, a critical stage in determining the viability of CCS in the country, and the ICF funding via the World Bank is supporting this project. The World Bank has provisionally allocated $25-27 million from the multi-donor CCS trust fund for the Pilot CO2 Storage Project. See Output 4 for further details on this project. A separate pilot capture pilot project is also planned as part of the World Bank supported operation.

**Mexico:** Mexico has the potential to implement CCS technologies on a significant scale. The World Bank is supporting Mexico to develop both capacity and technical knowledge needed to deploy CCS technology at scale to fully realise its benefits. The most critical step is to start the implementation of the planned capture pilot project, which will create the basis for a larger demonstration project and advance the application of CCS in the power generation and oil and gas sectors.

During Phase I (with a budget of $1.35m), the World Bank is helping the government of Mexico and national energy companies to:

- develop national CCS network
- develop in-country technical capacity and expertise to design and implement projects on capturing CO2 from power generation and industrial installations, and subsequently storing CO2 in geological formations, including depleted oil and gas fields and saline aquifers
- develop legal and regulatory frameworks for CCS
- develop a communications strategy to build awareness of CCS and engage the national public and communities living in the vicinity of capture/storage sites.

Phase II (provisionally allocated a budget of $12 million from the World Bank CCS Trust Fund) comprises the design, procurement, construction, operation and closure of a 2-MW capture pilot plant, producing 10 tonnes of CO2 per day at a gas fired power plant in Poza Rica. This is a small-scale pilot project but has the potential to be scaled up to a large-scale demonstration project with additional funding from Mexican Government and/or donors, which will capture significant CO2 per year. The duration of this project, including the pre-feasibility stage, will be about 5 years (2015-2020).

Completion of this project will comprise a critical step in Mexico's CCS roadmap, demonstrate the feasibility and potential of CO2 capture in Mexico, provide an indicative measure of CO2 capture costs in Mexico, build human capacity and experience, engage national and local stakeholders, and strengthen international linkages.

**Recommendations:**

Overall, both the World Bank and ADB have stepped up their activities to develop CCS technologies, in particular they have selected four pilot and demonstration projects in four emerging economies, in line with the UK's priority countries. However, there is a significant risk that delay could occur during the implementation phase. Delivery partners should take steps (e.g. government buy-in, necessary funding is in place for the full costs of these projects, public engagement to de-mystify CCS, collaboration with key stakeholders to learn lessons from other projects) to reduce the risk of delay in implementation of CCS pilot and demonstration projects.

It is recommended that both delivery partners look for opportunities to accelerate their internal approval processes and start the implementation phase. This will be essential if we are to truly demonstrate the potential of CCS in emerging economies, and thus accelerate the development and deployment of CCS.

**Impact Weighting (%):** 40%

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk: High.** Due to the fact that all four pilot and demonstration projects are in the planning phase,

and there is a significant risk that delay could occur during the implementation phase.

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

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**Output 1.2: Technical assessment of the potential to deploy CCS on natural gas plant completed**

**Output 1.2 score and performance description:** A, Outputs met expectation

**Progress against expected results:**

The log frame sets out that delivery partners would carry out a technical assessment of the potential to deploy CCS on natural gas plant, and to select a natural gas plant to pilot CCS technologies by 2018. We are on track to meet this Output, as both the World Bank and ADB are carrying out technical assessments of the potential to deploy CCS on a natural gas plant. Potentially two projects will look to do this:

i. as flagged above, the World Bank funded Phase II of the Mexico project is planned to support the deployment of a 2-MW capture pilot plant associated with a natural gas power plant. This will be the first such plant in the developing world.
ii. ADB has commissioned a study on CCS on Natural Gas-Based Power Plants in China, with a budget of $1.8m, due to be completed by August 2014. If assessed as financially and technically viable then the UK and the Global CCS Institute will work with the ADB to explore developing a pilot project associated with the 600MW Gaojing natural gas-based power plant. If this eventuates as planned, then this Output would substantially exceed expectations.

**Recommendations:**

World Bank should explore fast-tracking the approval and development of the planned capture plant for the Phase II of the Mexico project on a natural gas-fired generating station. World Bank CCS Trust Fund Manager and the project lead to update Donors at the next Steering Committee meeting on whether this is financially and technically feasible.

Following completion of the study on CCS on Natural Gas-Based Power Plants in China, ADB should assess and explore the potential of developing CCS on a natural gas plant in China. ADB should present options at the next Annual Donor Consultation meeting in March 2015.

**Impact Weighting (%):** 10%

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk:** Medium.

**Revised since last Review?** N/A. This is the first annual review of the CCS Programme.

Output 2: Increased knowledge of and support for CCS within government

**Output 2.1: No. of well-attended workshops on CCS focusing on demonstration and lesson learning**

**Output 2.1 score and performance description:** A+, Outputs moderately exceeded expectation

**Progress against expected results:**

The log frame sets out that six workshops would be funded by the World Bank and ADB CCS trust funds by 2016. Currently, we are on track to exceed this target. The ICF finance enabled the World Bank and ADB to raise their ambition and develop four pilot and demonstration projects, and as part of this they have also arranged workshops to engage with key stakeholders. They also plan to arrange additional workshops to share lessons learnt from these projects.

The ADB has funded five workshops – three in China in April 2013, October 2013, and January 2014; and two in Indonesia in November 2013 and March 2014. The ADB plan to hold four further workshops: at least two additional large-scale workshops in China, one in Indonesia and one in Pakistan (date to be confirmed).

The World Bank has funded two international CCS workshops in Washington in 2009 and 2011, one regional Southern Africa CCS workshop in Johannesburg (2011), and one regional workshop for the Balkans in Dubrovnik in 2011, two public engagement workshops in South Africa in 2013. Two additional workshops are planned in South Africa, as part of the prospective Programmatic Technical Assistance during 2015-16.

As well as funding workshops to share lesson learning, both the World Bank and ADB are working with host governments and wider stakeholders to develop strategic partnerships to increase capacity and capability within host governments. One of the primary objectives of any intervention is to encourage the development of policy incentives capable of supporting CCS to deliver large scale CO2 mitigation benefits. It is anticipated that UK ICF finance could be used to secure political support for the demonstration and deployment of CCS. DECC is working with the World Bank, ADB and the Global CCS Institute, as well as FCO and DFID country offices, to support host governments (China, Indonesia, South Africa and Mexico) to develop supporting CCS policies.

The World Bank and ADB are leading our engagement with emerging economies. We are also working closely with other donors, in particular the Global CCS Institute, who also have strong partnerships and engagements in these countries, and can further support the dissemination of knowledge coming out of these projects. They are developing a strategic partnership with host countries to get buy-in, and through conferences and workshops we will share lessons learnt. Through our engagements with host countries we will aim to achieve the following outcomes:

- government understanding of legal and policy issues and their application through legislation and regulation;
- technical knowledge and skill development in engineers, geologists, and project managers;
- understanding financial and commercial issues, risks and incentives by policy makers, lenders, and companies in order to overcome supply chain issues associated with demonstration; and

- the ability of companies and governments to effectively and genuinely engage with the public and local stakeholders around a specific CCS project.

As part of the Phase I of the South Africa project, the World Bank has committed to fund a $1.35m project to develop capacity within the South African government and key industries on CCS. The project delivered the following:

- Development of CCS regulatory approaches that fits within South Africa's existing regulatory framework, allowing the execution of a carbon dioxide test Injection and further commercial application of CCS technology in South Africa;
- A techno-economic analysis for implementation of CCS in the industrial and electricity generation sectors including matching potential carbon dioxide emission sources against prospective sinks and an assessment of applicable capture technologies;
- Building institutional capacity by conducting expert workshops, training, technical classes and study tours for government, industry and energy sector stakeholders;
- Initiating public and community engagement on the issues related to CCS deployment including potential environmental and social impacts.

The ADB has approved a technical assessment project to the amount of $800,000 for due diligence and to provide capacity strengthening activities for a proposed carbon capture, utilization and storage pilot project at the Tianjin Integrated Gasification Combined Cycle (IGCC) power plant in China. The project will facilitate the sharing of knowledge and best practice with policy makers, power generators, regulators, and other key developing countries such as India, Indonesia, Kazakhstan, Malaysia, Pakistan, Thailand, and Vietnam. This knowledge sharing, through regional workshops and conferences, will ensure that experiences on this innovative technology are disseminated to wider international and regional partners.

The ADB is also in the process of setting up three CCS centres (two in China and one in Indonesia). The aim is to increase our collaboration with the Chinese Government and local partners. ADB is leading on this, with support from the British Embassy in China and the Global CCS Institute. The aims are:

- conduct R&D on CCS;
- promote knowledge sharing in the region;
- strengthen collaboration in the region; and
- foster leadership in capacity development, including government policy and regulatory system needed for development and deployment of CCS.

**Recommendations:**

The World Bank and ADB should be encouraged to ensure approved projects have stakeholder engagement plans, and/or knowledge sharing dissemination mechanisms, and to report back regarding those mechanisms.

The World Bank and ADB should provide a summary of the outcomes of the CCS workshops to donors.

**Impact Weighting (%):** 10

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk:** Medium

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

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**Output 2.2: Cost benefit analysis of technology options for CO2 capture produced**

**Output 2.2 score and performance description:** A, Outputs met expectation

**Progress against expected results:**

The log frame has no target for this indicator. However, both the World Bank and ADB have done cost benefits analysis, as set out below:

In 2011, World Bank published the report "Carbon Capture and Storage in Developing Countries: A Perspective on Barriers to Deployment". This report is the effort of the World Bank Group to contribute to a deeper understanding of (a) the cost of integration of power generation with CCS technologies in the Southern Africa and the Balkans regions; (b) regulatory barriers to the deployment of CCS; and (c) global financing requirements for CCS and applicable project finance structures involving instruments of multilateral development institutions. http://elibrary.worldbank.org/doi/book/10.1596/978-0-8213-9609-4

In September 2013, the ADB published a report on the *Potential for Carbon Capture and Storage in Southeast Asia*, which focused on an assessment of the CCS potential in Thailand, Vietnam, Indonesia and the Philippines. It contains inventories of CO2 emission sources, estimates of overall storage potential, and an analysis of existing policy, legal, and regulatory frameworks with a view toward supporting future CCS operations. The report also presents a comparative financial analysis of first-mover CCS projects, highlights possible incentive schemes for financing CCS, and provides an actionable road map for pilot, demonstration, and commercial CCS projects. (http://www.adb.org/publications/prospects-carbon-capture-and-storage-southeast-asia)

As part of the Phase I of the Mexico project, the World Bank has commissioned a pre-feasibility study, which will report on the following:

- Compilation, assessment and selection of potential plants suitable for capture pilot plant.
- Selection of most suitable capture technology.
- Development of technical specifications for pilot plant.
- Development of estimates of capital and operating costs.

**Recommendations:**

Where feasible and relevant, ADB and World Bank projects should analyse if the chosen approach to promoting CCS in the host country is the most cost-effective, including how CCS compares to other low-emission technologies such as solar (on a non-subsidised basis).

**Impact Weighting (%):** 10%

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk:** Medium. More needs to be done to understand the costs of CCS development and deployment.

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

Output 3: Increased understanding of regional geology and storage potential

**Output 3.1: Appropriate number of seismic tests leading to the selection of suitable storage sites undertaken**

**Output 3 score and performance description:** A, Outputs met expectation

**Progress against expected results:**

This is on track to meet the output set out in the log frame. Two projects have been identified to demonstrate the potential of permanent storage of CO2 – in South Africa (funded from the World Bank CCS Trust Fund) and Indonesia (funded from the ADB CCS Trust Fund). For both projects storage sites have been identified.

The World Bank is supporting the South African Centre for CCS (SACCCS) to plan and carry out a Pilot CO2 Storage Project, a critical stage in determining the viability of CCS in the country, and the ICF funding via the World Bank is supporting this project. The World Bank has provisionally allocated $25-27 million for the Pilot CO2 Storage Project. The Pilot CO2 Storage Project is scheduled to inject 10,000 tonnes of CO2 per year into a selected geological storage site. The first injection is currently scheduled for 2017. It will be the first time that CO2 is injected into a South African geological formation. See Output 4 for further details on this project.

ADB is providing $225,000 for a small-scale capacity development technical assistance (Stage 1) that will develop pilot activities in Indonesia – in particular, a pilot storage project. The project will undertake the following activities for the pilot CCS project in Gundih gas field, Central Java, Indonesia: (i) develop preliminary engineering design and cost estimates for transport infrastructure, surface facilities, and test injection infrastructure, (ii) analyse financial viability, and (iii) review legal and

regulatory issues related to CCS pilots. Stage 1 is expected to be finalized in late 2014. In Stage 2, construction of surface facilities, test injection and CO2 monitoring will be carried out. Stage 2 will envision injecting about 10,000 tonnes of CO2 over a one-year period.

**Recommendations:**

The World Bank and ADB should consider how to engage with host country counterparts to accelerate the timescale for implementing the pilot storage projects in South Africa and Indonesia.

**Impact Weighting (%): 10%**

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk:** High. Even though two projects are selected (in South Africa and Indonesia) to demonstrate the potential of permanent storage, it is unlikely that these projects will be completed by 2016.

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

Output 4: South Africa undertakes test injections

**Output 4.1: Study to determine scope of South African test injection project**

**Output 4 score and performance description:** A+, Outputs moderately exceeded expectation

**Progress against expected results:**

It was expected that a study to determine the scope of South African test injection project would be completed by 2016. However, the World Bank, in partnership with the South Africa Centre for CCS (SACCCS) are on track to exceed this target. The SACCCS has developed a roadmap toward the first commercial demonstration of the technology. The next milestone is to plan and carry out a Pilot CO2 Storage Project and CO2 pilot capture project, a critical stage in determining the viability of CCS in the country. The World Bank has provisionally allocated $25-27m for the Pilot CO2 Storage Project.

The Pilot CO2 Storage Project is scheduled to inject 10,000 tonnes of CO2 per year into a selected geological storage site. The first injection is currently scheduled for 2017. It will be the first time that CO2 is injected into a South African geological formation. The source of CO2 will most likely be from an industrial facility (a chemical plant). However, a stand-alone pilot capture plant will also be supported by the World Bank CCS Trust Fund.

Two sites have been selected, and the next stage is field exploration, leading to a site selection and further characterisation. The World Bank will support the SACCCS to carry out the following three stages of this project:

1. Pre-Feasibility Study [Basin Exploration 2013-2015]
2. Feasibility [Site Characterization 2015-2016]: Based on the Basin Exploration, this component will characterise and finally select an injection site.
3. Procurement, Construction, Operation, Closure and Post Closure [2015-2018]: Design, the actual undertaking of the injection, monitoring, analyses and determination of CCS potential within a particular basin.

**Recommendations:**

As per the stakeholder engagement plan already developed, the World Bank to support the SACCCS to engage with key partners to build awareness of CCS, and engage the national public and communities living in the vicinity of storage sites.

**Impact Weighting (%):** 10%

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk:** Medium. The test injection project has South African government buy-in, and finance has been put in place to implement the project. However, negative public perceptions could delay this project.

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

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**Output 4.2: South Africa undertakes test injection on accelerated timeline**

**Output 4 score and performance description:** B, Outputs moderately did not meet expectation

**Progress against expected results:**

The total cost of this project is estimated at $50m, with $25-27 million from the World Bank CCS Trust Fund, $20 million from the South African Department of Energy and $5 million from Norway. The project is progressing well, however, the original target date for the test injection was in 2016. The log frame set out that capital spend will commence in FY2013/14. The delay occurred as a result of finding sources of funding and setting up the procurement process that are in line with the World Bank guidelines. Due to a revision in the project timetable by the SACCCS in 2013, it is now likely injection will commence in 2017. It should be noted that without the ICF contribution the project would have been delayed even further.

**Recommendations:**

The World Bank to work with the SACCCS to explore whether any further actions can be done to

accelerate the Pilot CO2 Storage Project. The World Bank CCS Trust Fund Manager and the project lead to update Donors at the next Steering Committee meeting on what actions can be taken to potentially accelerate implementation of the Pilot CO2 Storage Project.

**Impact Weighting (%):** 10%

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Risk:** High. Currently the project has been delayed by one year. However, without ICF and other donor supports this project would have experienced further delay in financing this project.

**Revised since last Review?** N/A. This is the first annual review of the CCS Capacity Building Programme.

**Section B: Results and Value for Money.**

**1. Progress and results**

**1.1 Has the log frame been updated since last review?** *If so, explain why.*

**No.** However, the log frame will be revised by end of this year to include new information on projects funded by the World Bank and ADB.

**1.2 Overall Output Score and Description:** A, Outputs met expectation

**1.3 Direct feedback from beneficiaries (where appropriate in 6 monthly reviews; required in annual reviews)**

The following stakeholders provided feedback: World Bank; ADB; Global CCS Institute; Norway; FCO post China; FCO post South Africa; UK Climate Change Unit Indonesia.

Those providing feedback suggested:

- The World Bank highlighted that without the UK DECC funding, it would have been exceedingly difficult for the South African Government to mobilize sufficient resources to fund the test injection project. It is also likely that preparation of the test capture project in Mexico would also have been substantially delayed.
- DECC has worked closely with the World Bank team on shaping the Phase II assistance and has provided useful guidance on priorities and policy constraints that have helped focus design efforts effectively.
- ADB has built a strong partnership with the Indonesian project partners, resulting in an effective first phase of the project. With support from the UK Climate Change Unit Indonesia,

ADB are well placed to secure Government of Indonesia backing to proceed with the pilot project phase.

- The Global CCS Institute commends the UK for the £60 million contribution to supporting CCS capacity building in developing countries.
- The Institute is pleased to continue to collaborate with DECC on the direction of the CCS Trust Funds.
- The Government of Indonesia and the Indonesian state-oil company, Pertamina, appreciate that this is the first CCS pilot project in the country and fully support the activities funded by the ADB and JICA.
- ADB is in discussion with the Government of Indonesia to set up a regional Centre of Excellence (CoE), and the pilot project in Gundih will be one of the core activities to be supported under the CoE.

**1.4 Summary of overall progress**

Good progress has been made, with some areas exceeded expectations. In particular, the number of small-scale demonstration projects established in developing countries has substantively exceeded expectations.

ICF funding to the CCS Trust Funds managed by the World Bank and ADB is preparing the ground for CCS development in the coming years. The pipeline of projects that is being developed has the potential to be transformational. These projects, once implemented, will raise the level of technical understanding of CCS within key developing countries, leading to the establishment of necessary policy frameworks and incentive structures to support CCS demonstration and ultimately accelerate the deployment of CCS.

There has been substantial interest in developing countries in exploring the viability of CCS as 6part of their mitigation strategy, including in the target countries of China, Indonesia, South Africa and Mexico. We are in the process of developing pilot and demonstration projects in these four target countries.

**1.5 Key challenges**

1) **Selecting projects / increasing disbursement rate.** The current disbursement rate is acceptable, however, with the ICF cash injection at the end of 2012 providing significant resources to the World Bank and ADB to scale up their ambition. The World Bank and ADB agreed to actively promote CCS in target countries, including China, Indonesia, Mexico and South Africa in 2014. We are working with the World Bank and ADB to develop other pilot and demonstration projects, which would also lead to speeding up of funding for projects.

2) **CCS interventions are necessary but not sufficient to be transformational and do not alone significantly accelerate CCS deployment.** This is a long term risk for DECC – that we fund capacity building projects that help take the country down the critical path to CCS implementation, but are not sufficient in terms of financing demonstration scale activities to create the conditions for subsequent commercial deployment of CCS. We are minimising this risk through working with the

World Bank and ADB to develop a pipeline of projects to deliver objectives set out in the CCS Business Case. However, there is a significant risk that developing countries like China would want to develop CCS expertise with emphasis on CCS readiness and the Enhanced Oil recovery (EOR) as a means to lower CCS costs, rather than focus on permanent storage of CO2.

3) **Attract and where relevant incorporate additional finance from the private sector and other donors beyond the UK, Norway and GCCSI.** It is a challenge to attract private finance as capacity building projects will not deliver immediate financial gains. However, the World Bank and ADB are working with state-owned companies to fund R&D projects, as well as contribute towards more expensive demonstration projects.

**1.6 Annual/6 monthly Outcome Assessment**

While there are project specific indicators in place, the programme is yet to develop targets for quantitative KPIs. These will be finalised as we finalise all CCS projects. In most cases actual numbers will be reported. The project will report against the transformational indicator, as set out in Section 6.2.

| **Indicator** | **Baseline (year)** | **Milestone 1 (year)** | **Milestone 2 (year)** | **Milestone 3 (year)** | **Final target (year)** |
|---|---|---|---|---|---|
| Number of direct jobs created | - | - | - | - | - |
| Change in Greenhouse Gas emissions | | | | | |
| Volume of public finance mobilised | | | | | |
| Volume of private finance mobilised | | | | | |
| | | | | | |

**2. Costs and timescale**

**2.1 Is the project on-track against financial forecasts: Y/N**

The World Bank is expected to draw down the full £25m by the end date of December 2018. However, it is expected that the ADB will need an extension from its current end date of December 2015, and we

will look to bring this in line with the end date of the World Bank (i.e. end of December 2018). This is to ensure that we only disburse when funding is needed and not in advance of need.

The World Bank and ADB are developing a pipeline of projects consistent with the CCS log frame. Four pilot and demonstration projects have been identified in China, Indonesia, South Africa and Mexico. The full allocated ICF finance will be used to support these projects.

**2.2 Key cost drivers**

The World Bank and ADB are operating within their maximum allocated service charge, which covers incremental cost for the administration, management, supervision and operation of the Trust Funds.

**2.3 Is the project on-track against original timescale: Y/N**

Yes for the World Bank.

No for the ADB. In December 2012 when we negotiated the disbursement schedule with the ADB, it was expected that ADB would draw-down the full £35m by December 2015. However, this timescale was over ambitious given the amount of time it takes to develop CCS projects. We have now agreed a revised timescale with ADB based on their pipeline of CCS projects. This will ensure that we only disburse when funding is needed and not in advance of need.

**3. Evidence, Monitoring and Evaluation**

We have agreed that both the World Bank and ADB will carry out two evaluations each: a mid-term evaluation in 2015 and an end of programme evaluation in 2018/19. Based on the theory of change we have a clear idea what we want to evaluate and what data is needed to provide evidence on the effects of our contribution.

The monitoring strategy for this intervention will rely upon the provision of regular financial and non-financial reporting by delivery partner organisations in combination with publically available information.

The monitoring strategy is consistent with the ICF Results Framework. Targets for the following KPIs will be developed in partnership with the World Bank and ADB:

- Level of institutional knowledge or awareness of climate change issues as a result of ICF support (qualitative assessment)
- Level of integration of climate change in national planning as a result of ICF support (qualitative assessment)
- Volume of finance, public and private, leveraged (reported separately)
- Number of direct jobs created – this will reflect the job opportunities created directly through

capacity building activities
- Degree to which the intervention is 'transformational' (qualitative assessment)

There are a number of project specific indicators, as set out in the log frame (see Annex A).

Given the innovative nature of CCS and the limited finance in supporting CCS to date the expectation is that many of these indicators will start from a zero baseline. In addition to the KPIs, this CCS Programme will also report on a series of project specific indicators.

Both the ADB and World Bank produce regular reports setting out the activities supported by Trust Fund monies and including financial statements. These reports will be made available to the UK Government in order to demonstrate that funds are not being misappropriated and are being spent in a manner consistent with donor expectation. The production of reports will also facilitate ongoing performance review.

**The Role of Evaluation:**

A mid-term evaluation will be most effective in informing the UK Government what has worked best in each national context, and where improvements could be made. To assess the impacts of both CCS trust funds, the evaluation will analyse to what extent, how, and why / why not, progress has been made towards achieving the following intended outcomes:

- increased knowledge amongst governments, academia and civil society of the role and relevance of CCS in enabling fossil fuels to be used to supply power sustainably
- increased investment of developing country finance in CCS initiatives and research
- increased attention given to the development of policy frameworks to support CCS in developing countries
- increased level of commercial activity relating to CCS in key markets
- increased investment from other donor countries to support the development and deployment of CCS in developing countries

All evaluations will cover qualitative and quantitative KPIs, and in particular will cover the following key questions:

Transformational Change
- What evidence is there that the ICF interventions have led to country level transformational change?
- What evidence is there that the ICF interventions have led to fostering of political will to act on climate change?
- What evidence is there that the ICF supported activities are encouraging innovation and testing new approaches and ideas?
- What evidence is there that ICF funded projects have provided sufficient knowledge and crafted the appropriate partnerships to enable scaling up (into policy and budget frameworks) and scaling out (to locations within country and beyond) of successful interventions?

- What has enabled/hindered successful innovations to be taken forward?

When developing evaluation plans, both the World Bank and ADB will follow good practice in the OECD-DAC criteria:

Impact

- Were the expected programme outcomes and impact (as outlined in the Theory of Change) achieved?
- What benefits did the programme deliver?
- Were there any unintended impacts of the programme?
- How well did the programme attract finance and innovation from the private sector?
- Did the programme achieve value for money?

Relevance

- How relevant and aligned is the programme to the overall ICF objectives, as set out in the CCS Business Case?
- Did the programme interventions target the desired beneficiaries?
- Did the programme address the relevant barriers to markets?
- Did the programme offer relevant and useful evidence to inform and encourage the uptake of CCS technologies?

Effectiveness

- Did the programme increase finance / information flows for CCS technologies?

Efficiency

- How efficiently did the programme deliver benefits?
- Were sufficient and representative pipeline projects generated?
- Were projects processed /accredited efficiently and in a timely manner (e.g. time take from concept to approval)?
- Is the programme an efficient delivery channel?
- Was the process appropriately designed so that all donor's objectives were met?
- Were development benefits delivered in an efficient way compared with delivery through another mechanism (e.g. direct funding of projects)?

Sustainability

- Are the programme interventions sustainable?
- Is the business model replicable?
- Are the projects using these technologies commercially viable?
- Will the skills and capabilities built through the programme be sustained?

## 4. Risk

### 4.1 Output/Outcome Risk Rating: Low/Medium/High

**High.** This project is a high investment risk due to the assumptions underpinning the effectiveness of capacity building activities in influencing developing country governments. However, this project is in line with the risk appetite for the ICF as the potential reward of success is high.

### 4.2 Assessment of the risk level

The risks associated with this investment are actively being managed. Risks are monitored on a monthly basis and reported to senior managers, in accordance with the escalation process.

### 4.3 Risk of funds not being used as intended

This is a very low risk. Both the World Bank and ADB have existing policies and procedures to prevent and combat fraud and corruption. It is also agreed that both delivery partners will inform DECC if they suspect fraud or corruption relating to the project activities financed by the Fund and take remedial actions in accordance with their respective policies and procedures.

## 5. Value for Money

### 5.1 Performance on VfM measures

**Economy** (*Are we or our agents buying inputs of the appropriate quality at the right price?):* There is no reason that the economic arguments in favour of delivering the CCS Programme in cooperation with the World Bank and ADB have changed since the approval of the Business Case. Financing through the World Bank and ADB allows funding to be channelled to ICF priority countries that do not have HMG programme delivery capability in Posts, or expertise to plan and deliver CCS projects. Both delivery partners have existing safeguards and investments criteria in place to ensure that projects costs are minimised. The Donors, including DECC, sit on their respective steering committee, which enables donors to challenge investment decisions and costing of projects.

**Efficiency** (*How well do we or our agents convert inputs into outputs?*): The ADB charges a service fee of: i) 5% of the amount disbursed for grant components of investment projects up to US$ 5 million, or 2% (with a minimum of US$ 250,000, whichever is greater) of the amounts disbursed for the same type of grants above US$5 million; and ii) 5% of the amounts disbursed for technical assistance operations. The fees are charged based on actual project disbursements, however, the equivalent amount for the entire project is already set-aside/earmarked as soon as the project is approved by ADB but will only be drawn from when disbursements are made. At project completion, undisbursed amounts including undisbursed fees are returned to the fund as savings. Total contribution from donors to the ADB CCS Trust Fund stood at $41.1m at July 2014, with $9.0m committed (net of project savings) and the total

fees charged is $0.2m.

The World Bank will charge 2% of contributions received to cover the standard costs of trust fund administration incurred by the Bank. In addition, for costs incurred by the Bank for CCS Trust Fund programme management, the Bank may charge up to a maximum of 8%. Total commitment from donors to the World Bank CCS Trust Fund stood at $58.3m[3] at July 2014, with $8.3m allocated to Phase I work programs, $37.0 targeted to Phase II work programs in South Africa and Mexico and the total fees charged is $1.1m.

**Effectiveness** (*How well are the outputs from an intervention achieving the desired outcome on low carbon development?)*: At this stage there is limited information to support this section of the review. However, the UK contribution of £60m – which is significant but not enough to meet the desired outcomes of accelerating development and deployment of CCS in emerging economies – added to the contribution from other donors and host government could deliver the four planned pilot and demonstration projects, and show that CCS is a viable option for emerging economies like China, Indonesia, South Africa and Mexico. When the four planned projects are implemented the CCS Programme could have a transformational impact.

During the March, 2014 ICF results collection the CCS Programme received a score of 3 against ICF transformational change KPI which suggests that "tentative evidence points to likely transformational change" (for details see Section 6.2 below). The Programme will continue to report against this transformational KPI and develop a framework to report against the other two qualitative ICF KPIs to track performance on the outcome level and measure programme effectiveness.

**5.2 Commercial Improvement and Value for Money**

Further analysis of this aspect of value for money will be possible once individual project have developed further.

**5.4 Does the project still represent Value for Money : Y/N**

Yes. At this stage there is limited information to support this section of the review. However, the CCS Programme has been successfully developing four small to large-scale pilot and demonstration projects, and has met or exceeded nearly all output indicators to date. Therefore it has demonstrated value for money in terms of achieving its objectives.

**5.5 If not, what action will you take?**

N/A

[3] The Bank of England exchange rate as of June 30 2014 (1.7097 USD/GBP) has been used for the purposes of converting the receivables of GBP 15 million from the U.K.

## 6. Project partnerships, sustainability and transformation

### 6.1 Partnerships

The project has delivered a strong result in terms of developing effective relationships between donors (UK, Norway and Global CCS Institute) and recipient countries to share knowledge and expertise in development and deployment of CCS.

We are developing a strategic partnership with host governments, through working with the World Bank, ADB, Global CCS Institute, FCO and DFID country offices to increase collaboration on development of CCS technologies. We are also working with the ADB to set up three CCS centres (two in China and one in Indonesia) to increase our collaboration with the Chinese and Indonesian governments and industries. Funding channelled through World Bank is being used to set up a CCS centre in Mexico similar to the one which operates in South Africa.

### 6.2 Transformation

Qualitative assessment of progress against the transformational indicator.

**1) Fostering political will to act on climate change**

- Developing countries recognise the role that CCS must play in delivering a cost effective emissions reduction strategy and take action to promote deployment
- Introduction of a policy framework supporting CCS deployment in one or more developing countries
- Increased knowledge of and support for CCS within government

**Progress update:** South Africa is actively engaged in CCS deployment. The South African Centre for CCS (SACCCS) (a government agency) has developed a CCS Roadmap identifying the five milestones toward the commercial demonstration of the technology. This Roadmap has been endorsed by the South African Government. The first two steps have successfully been undertaken; the next major milestone in the Roadmap is to implement a $CO_2$ test pilot storage project and a stand-alone pilot capture project, a critical stage in determining the viability of CCS in the country. The ICF funding via the World Bank is supporting this project.

Until recently, China saw CCS as too expensive. Moreover, the slow progress in demonstrating the potential of commercialisation of CCS in OECD countries created a wait and see attitude of policy-makers vis-à-vis the promotion of CCS demonstration in China. However, we are now seeing a positive change towards willingness to develop CCS demonstration projects. The Chinese Government has given the green light to develop a pipeline of CCS projects, including to those supported by the UK ICF funding through the ADB CCS Trust Fund. The World Bank CCS Trust Fund is also supporting CCS capacity building, including working with the China Power Investment Corporation, one of the biggest power producers in China. China currently has 21 large-scale projects already in various stages of planning (http://www.globalccsinstitute.com/projects/browse).

China recognises the potential of CCS on reducing air pollution and GHG emissions, as reported on the Global CCS Institute's website: "CCS was identified in [China's] *Outline for National Medium and Long-term Science and Technology Development Plan Towards 2020* as one of the leading-edge technologies for further development. CCS has also been supported under China's science and technology programmes during the 10th and 11th five-year planning periods, and support for the technology has increased under the current *12th Five-Year Plan (FYP)*."
(http://www.globalccsinstitute.com/location/ccs-china)

The UK is well placed to push this agenda further. Most significantly, our support for the ADB CCS Trust Fund will provide a major new opportunity for greater UK influence on CCS development in China.

**2) HMG supported activities are encouraging innovation and testing new approaches and ideas**

- At least one developing country takes forward a full chain CCS demonstration at scale
- No. of small-scale capture plants and storage projects established in developing countries

**Progress update:** The GreenGen project in Tianjin, China, is a pilot-scale full chain CCS demonstration project, which will consist of construction of a CO2 capture plant with the capacity to capture up to 100,000 tonnes of CO2 per year, when fully operational. This has the potential to be transformational and demonstrate the potential of CCS in China.

We are also supporting test pilot and demonstration projects in South Africa, Indonesia and Mexico. In total, ICF finance will support four small, medium and large-scale demonstration projects.

**3) HMG supported activities are being replicated by others**

- Increased understanding of regional geology and storage potential
- No of well-attended workshops and conferences on CCS focusing on demonstration and lesson learning

**Progress update:** We are working with the ADB to set up three CCS centres (two in China and one in Indonesia). The aim is to increase our collaboration with the Chinese Government and local partners. ADB is leading on this, with support from the British Embassy in China and the Global CCS Institute. The aims are: conduct R&D on CCS; promote knowledge sharing in the region; strengthen collaboration in the region; and foster leadership in capacity development, including government policy and regulatory system needed for development and deployment of CCS. This will significantly increase understanding of regional geology and storage potential in the region.

**Overall rating on Transformational Key Performance Indicator**

| | |
|---|---|
| 3 | Tentative evidence points to likely change |

## 6. Conditionality

### 6.1 Update on specific conditions

- Increased technical capacity and institutional awareness will enable physical deployment of CCS.
- Capacity building accelerates the demonstration of CCS technology, and there is government buy in and a pipeline to take projects forward to demonstration.
- Host governments continue to support the SACCCS work programme.
- ICF funds are accompanied by Norwegian and GCCSI Investment and suitable commercial and academic expertise.

## 7. Lessons learned, conclusions and actions

Overall, the CCS Programme is progressing well as both the World Bank and ADB are developing a pipeline of projects to accelerate development of CCS in developing countries, including through pilot and demonstration projects in China, Indonesia, South Africa and Mexico. However, some key challenges remains:

- Implementation of the planned four pilot and demonstration projects – in particular, identifying mitigating actions to prevent slippages.
- Attract and where relevant incorporate additional donor finance beyond the UK, Norway and GCCSI.
- Attract private sector funding to support R&D.

Key actions to be taken forward in the coming months are:

- Work with the World Bank and ADB to review pilot and demonstration projects at every Steering Committee meetings to ensure we identify risks early and take the necessary actions to ensure these projects go ahead as planned.
- Continue to work with the World Bank and ADB to engage with host governments to ensure political buy-in for the planned pilot and demonstration project, and use the ICF finance to leverage funding from host governments.
- At the next Steering Committee meeting, explore how we can accelerate disbursement of funding for the four pilot and demonstration projects.

**8. Review Process**

The review was conducted in conjunction with the World Bank and ADB Trust Fund Managers, FCO and DFID country offices, and DECCS colleagues including economists and the PMO. Specific project managers from the World Bank and ADB also contributed. Two live scoring sessions to score the intended outputs were held with the World Bank and ADB respectively in July 2014.

*Conducted by: Abu Zaki*
*Cleared by SRO: David Capper*

**Annexes:**
*Annex 1: Log frame*

## *Annex A: CCS Programme Log Frame*

| Logframe: Carbon Capture and Storage: Accelerating developing country deployment | | | | | | | |
|---|---|---|---|---|---|---|---|
| **IMPACT** | **Impact Indicator 1** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | |
| Developing countries recognise the role that CCS must play in delivering a cost effective emissions reduction strategy and take action to promote deployment | At least one developing country establishes legal framework for CCS in order to enable projects to move forward | **Planned** | No developing country has a legal framework to support the safe development of CCS technologies | Announcement by developing country government of intent to produce legislation | Legislation passes through relevant government process | 2020 | |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | |
| | | | FCO Network / Delivery partners / CCS industry players | | | | |
| | **Impact Indicator 2** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | |
| | At least one developing country takes forward a full chain CCS demonstration at scale | **Planned** | No demonstrations exist | Demonstration launched on power plant including CO2 capture and storage | Construction commences | 2020 | |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | |
| | | | Delivery partners / FCO network / CCS Industry players | | | | |

| **OUTCOME** | **Outcome Indicator 1** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | **Assumptions** |
|---|---|---|---|---|---|---|---|
| 1. Industrial & organisational preparedness to deploy CCS when technology is sufficiently mature<br><br>2. Introduction of a policy framework supporting CCS deployment in one or more developing countries | Increased level of private finance channelled toward CCS Research Demonstration and deployment activities in key developing countries | **Planned** | Private R&D finance allocated toward CCS very limited (scale unknown at this time) | Private companies in at least one key developing market make public statement of support for CCS R&D | Finance committed | 2016 | Contingent on successful outcomes, on small scale demonstration and capacity and knowledge, and in context with an overall global mitigation strategy to limit climate change, will lead to the establishment of the necessary policy frameworks and incentive structures to support CCS demonstration on commercial scale and ultimately the deployment.<br><br>ICF funds are accompanied by Norwegian and GCCSI Investment and suitable commercial and academic expertise. |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | |
| | | | MDB analysis / FCO network / S&I officers | | | | |
| | **Outcome Indicator 2** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | |
| | At least one developing country develops a policy framework for CCS | **Planned** | Few if any developing countries publically acknowledge CCS as a technology for deployment, though some reference to the importance of R&D is made | Announcement by developing country government of intent to produce legislation | Legislation passes through relevant government process | 2020 | |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | |
| | | | Delivery partners / FCO network | | | | |
| **INPUTS (£)** | **DECC (£)** | | **Govt (£)** | **Other (£)** | **Total (£)** | **DECC SHARE (%)** | |
| | **£60m ($95m)** | | **$40m** | **N/A** | | **70%** | |
| **INPUTS (HR)** | **DECC (FTEs)** | | | | | | |
| | **0.5** | | | | | | |

| **OUTPUT 1** | **Output Indicator 1.1** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | **Assumption** |
|---|---|---|---|---|---|---|---|
| Increased capacity in industry and key institutions to aid the development of CCS | No. of small-scale demonstration projects established in developing countries | **Planned** | China is currently the only one of the three target countries to have any CCS demonstrations. None are full chain and applied to power station technologies | The delivery of a CO2 capture demonstration in Indonesia | South Africa undertakes a small scale CO2 demonstration on a power plant | 2018 | Increased technical capacity and institutional awareness will enable CCS physical deployment. This assumption needs to be tested through an evaluation. |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | |
| | | | Delivery partners / FCO network / CCS Industry players | | | | |
| | **Output Indicator 1.2** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | |
| | Technical assessment of the potential to deploy CCS on natural gas plant completed | **Planned** | No assessment has been carried out on the potential to deploy CCS on a natural gas plant | MDBs to carry out a technical assessment of the potential to deploy CCS on natural gas plant completed | Potential natural gas plant identified | 2018 | |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | **RISK RATING** |
| | | | | | | | |

| **OUTPUT 2** | **Output Indicator 2.1** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | **Assumptions** |
|---|---|---|---|---|---|---|---|
| Increased knowledge of and support for CCS within government | No of well-attended workshops on CCS focusing on demonstration and lesson learning | **Planned** | 0 | 3 | 6 | 2016 | Capacity building accelerate the demonstration of CCS technology, and there is government buy in and a pipeline to take projects forward to demonstration. |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | |
| | | | Delivery partners / FCO network / CCS Industry players | | | | |
| | **Output Indicator 2.2** | | **Baseline** | **Milestone 1** | **Milestone 2** | **Target (date)** | |
| | Cost benefit analysis of technology options for CO2 capture produced | **Planned** | No country specific analysis of CO2 capture options has been produced for either Indonesia or South Africa | | | | |
| | | **Achieved** | | | | | |
| | | | **Source** | | | | **RISK RATING** |
| | | | Delivery partners / FCO network | | | | |

| OUTPUT 3 | Output Indicator 3.1 | | Baseline | Milestone 1 | Milestone 2 | Target (date) | Assumption |
|---|---|---|---|---|---|---|---|
| Increased understanding of regional geology and storage potential | Appropriate number of seismic tests leading to the selection of suitable storage sites | Planned | No seismic tests have been carried out | Locations for seismic testing identified | Tests undertaken | 2016 | Capacity building will facilitate many activities, including develop the information, tools, skills, expertise and institutions of individuals, organisations, industry and governments required to increase understanding of regional geology and storage potential. |
| | | Achieved | | | | | |
| | | Source | | | | | |
| | | SACCCS / FCO network / BGS or industry partners | | | | | |

| OUTPUT 4 | Output Indicator 4.1 | | Baseline | Milestone 1 | Milestone 2 | Target (date) | Assumptions |
|---|---|---|---|---|---|---|---|
| South Africa undertakes test injections | Study to determine scope of South African test injection project | Planned | Study yet to be carried out | Study initiated | Report produced and fed back to RSA Govt | 2016 | South African government continue to support the SACCCS work programme. |
| | | Achieved | | | | | |
| | | Source | | | | | |
| | | SACCCS / FCO network | | | | | |
| | Output Indicator 4.2 | | Baseline | Milestone 1 | Milestone 2 | Target (date) | |
| | South Africa undertakes test injection on accelerated timeline | Planned | Current plan makes provision for test injection in 2016. Finance is not secure | Capital spend associated with test injection made in 2013/14 | Test injection project completed | 2016 | |
| | | Achieved | | | | | |
| | | Source | | | | | |
| | | SACCCS / FCO network | | | | | |