

# The Strategic Analysis of the Global Status of CCS – a baseline study

## 1. Purpose

The purpose of this project is to develop a comprehensive baseline report on the status of CCS technology deployment covering technical, regulatory, economic, geographical, research/development capability together with an assessment of the status of announced projects. It will identify the progress being made towards the desired 20+ demonstration projects and estimate the current anticipated trajectory of achievement. A major feature of the work will be a status report on the position of large CCS demonstration as of March 2009.

This work will be used in a range of Australian Government Ministerial level meetings scheduled for October 2009 with initial findings being available for the G8 meetings in June-July 2009.

This work will allow the Global CCS Institute to:

- (a) identify challenges and related opportunities that should be focused on to accelerate the broad deployment of CCS technology;
- (b) evaluate and track annually the deployment of CCS; and
- (c) prepare an annual publication on the international state of CCS.

## 2. Scope of Work

1. The Contractor will provide the following five reports:

- (a) A comprehensive survey of all CCS projects around the world. For each CCS project a thorough range of information requirements will be gathered via site visitations, direct contact with project owners and desktop research. This information will fully enable a complete CCS project database to be compiled, updated and maintained and for projects to be directly compared (**First Report**).
- (b) A detailed analysis of capture, transport and storage cost structures for power plants and a select range of industrial activities. This will provide comprehensive cost estimates of both delivered electricity and additional production costs for industrial process and allow informed evaluation of CCS options to be made (**Second Report**).
- (c) A detailed assessment of the policy status for supporting CCS development around the world. The intent is to provide on a country or regional basis, where appropriate, robust policy analysis and advice to reduce regulatory and economic impediments to the deployment of CCS technologies (**Third Report**).
- (d) A comprehensive list and analysis of existing research and development networks (government, academia, industry and institutes) around the world. This will identify, collect and analyse a range of information on CCS research

and development networks, identify research and technology gaps and develop non-prescriptive recommendations to address these (**Fourth Report**).

(together "**Foundation Reports**")

- (e) A comprehensive assessment of the gap and barriers between existing CCS projects and the demonstration of large scale CCS projects across the world today. By synthesising the research of the first four reports, this report will identify key commercial and non-commercial gaps to the demonstration of large scale CCS projects across the world today and develop non-prescriptive strategies to address these (**Final Report**).
2. In the **first phase** of this project, the Contractor must develop a detailed outline of each Report. This outline will be used to clarify the scope and quality of each Report.
  3. In the **second phase** of this project the Contractor must develop all of the Foundation Reports and the Final Report:
    - (a) The **First Report** will identify the global status of CCS projects as of March 2009 by category (industrial-scale, demonstration, pilot and other). For each CCS project, a comprehensive range of information requirements will be gathered through direct contact and research. Direct contact will involve site visitations, face to face meetings, teleconferences and workshops with CCS project sponsors, project decision makers, funding institutions and agencies, insurance groups engaged in CCS development, supply chain groups and technology providers, environmental agencies, design institutes and relevant community groups to ensure a comprehensive picture of the real status of CCS demonstration projects is developed. This will require:
      - (i) including at least one Department or Resources, Energy and Tourism (RET) (or Global CCS Institute as the case may be) representative in site visitations and providing relevant information about meeting arrangements;
      - (ii) identifying what information is commercial in confidence to project owners and defining protocols for maintaining confidentiality of information;
      - (iii) gathering information on each CCS project that includes but is not limited to:
        - (A) the location and region of the project;
        - (B) any relevant information on the regulatory or economic environment the project operates under;
        - (C) aim of project, overview and key deliverables;
        - (D) current status including accomplishments and challenges;
        - (E) the project proponents and sponsors;
        - (F) a detailed description of the type of project, the technologies used, the application (separation, capture, transport, storage and/or integration) area, the project phases and milestones;
        - (G) scope for potential integration;

- (H) any research and development activities or aspects associated with the project;
  - (I) a breakdown of actual or estimated project costs;
  - (J) the level and types of funding provided;
  - (K) the key expertise and skills involved in the project;
  - (L) the actual or proposed volume and fraction of CO<sub>2</sub> captured, transported and stored;
  - (M) dates of announcement, start, expected maturity, and completion (if relevant);
  - (N) broader technology issues such as existing patents and intellectual property;
  - (O) any issues such as public acceptance, repeatability, timeframes, sustainability;
  - (P) any existing or proposed mechanisms the project has or participates in for reporting results, sharing information or capacity building;
  - (Q) related links and references; and
  - (R) key contact(s).
- (iv) drawing together the information gathered on each CCS project and developing a CCS project database that can be independently updated, modified and maintained by RET (or the Global CCS Institute as the case may be). The database will have the capability to allow direct comparison and categorisation of CCS projects and will be developed in a software platform that is compatible with RET's (or the Global CCS Institute as the case may be) information technology system; and
  - (v) categorisation of the projects by key region;
  - (vi) in addition to the information sourced, this Report will also define the methodology used to categorise CCS project types (industrial-scale, demonstration, pilot and other).
- (b) The **Second Report** will analyse capture, transport and storage cost structures for power plants and a select range of industrial activities. Industrial examples could include gas processing, fertiliser plants, iron and steel mills, chemical plants, cement plants or aluminium production. The development of comprehensive cost estimates of both delivered electricity and additional production costs for industrial process can allow informed evaluation of CCS options to be made. On a key regional basis this will involve:
- (i) a detailed assessment of the costs structure of a number of existing and proposed demonstration applications of CCS technologies, together with any relevant desktop analysis. The desktop analysis must be ground-proofed against existing and proposed applications;

- (ii) developing a transparent methodology for estimating costs in both power and industrial applications. Estimates of costs should differentiate between capital costs and operating costs, and identify their key components. For power plant applications, estimates of levelised costs should also be included. It is anticipated that costs estimates will be periodically updated so all assumptions and calculations should be fully documented. The outcome of the Contractor's services will be a cost methodology in a software platform that:
    - (A) RET (or the Global CCS Institute as the case may be) is able to independently conduct future cost modelling and estimations; and
    - (B) is compatible with the information technology system of RET (or the Global CCS Institute as the case may be);
    - (C) is identified and recommended by the Contractor and agreed to by RET (or the Global CCS Institute as the case may be);
  - (iii) developing templates that characterise costs and identify key cost components (design, development, procurement, construction, commissioning and operation and maintenance);
  - (iv) developing sensitivity analysis for accuracy of identified key cost components;
  - (v) analysis of the cost of developing fully integrated applications for both power and select industrial applications;
  - (vi) developing cost comparisons between plants and processes with CCS and without CCS technologies; and
  - (vii) identifying, with supporting rationale, those project cost elements that might have the most opportunity to decrease over time as knowledge and understanding in demonstration scale activities occurs.
- (c) The **Third Report** will assess the policy status for supporting CCS development around the world. The intent is to provide robust policy analysis and advice to reduce regulatory and economic impediments to the deployment of CCS technologies. On a country, or regional basis where appropriate, the Contractor will:
- (i) identify policy frameworks that have been created or proposed to support the deployment of low emission technologies through imposing a cost on emitting carbon dioxide into the atmosphere;
  - (ii) analyse these specific policies (market mechanisms, fiscal, R&D support or regulatory obligations) and determine the extent of support provided to CCS technology deployment;
  - (iii) identify policies and legislative support for the effective transport and storage of carbon dioxide. This will include:

- (A) assessment of the nature and impacts of the risks to be managed. This may include health and safety as well as environmental issues;
  - (B) assessment of the nature of the liabilities associated with storage;
  - (C) identification of what should be regulated to mitigate risk and ensure liability is allocated to cover damages;
  - (D) for storage, specific issues could include site selection, decommissioning, stewardship and long term liability;
  - (E) permitting rules for different activities: capture, transport, storage;
  - (F) establishing requirements for site selection, injection operation, monitoring plans;
  - (G) defining the limits of environmental contamination by CO<sub>2</sub> and required remedial action;
  - (H) the interaction with regulation designed to protect resources and vulnerable areas: drinking water, protected habitats, populated areas, petroleum resources;
  - (I) defining mechanisms to ensure funding for monitoring and verification of storage over the long term;
  - (J) the detailed rules linking CCS to emissions trading, such as in the European Union, the Kyoto Protocol and CPRS;
  - (K) mechanisms for cross-border regulatory oversight, given the possibility of plume migration;
  - (L) legal options for liability of private actors and States in terms of environmental integrity and impacts, particularly in relation to long-term permanence of carbon storage;
- (iv) identify possible policy or regulatory gaps to support CCS technologies where demonstration projects are anticipated before 2020;
  - (v) identify any commonly known policy or regulatory disincentives to the deployment of CCS technologies;
  - (vi) provide case studies outlining policy approaches employed in various regions and trends in legal and policy development;
  - (vii) provide case studies identifying existing legal arrangement and issues, barriers and risks; and
  - (viii) provide references to relevant and respected literature and studies.
- (d) The **Fourth Report** will compile and map existing research and development networks (government, academia, industry and institutes) around the world. Research and development topics that should be addressed include CCS technologies, regulations, economics, public awareness and understanding,

capacity building, information sharing, political, regional and environmental issues, and other areas relevant to the deployment of CCS. The intent of this section is to identify vital development pathways that should be resourced or expanded to accelerate the deployment of CCS technology. This will involve:

- (i) collecting and analysing a range of information on CCS research and development networks (government, academia, industry and institutes) around the world through desktop analysis, face to face meetings, site visits and teleconferences including but not limited to:
    - (A) name of network and organisations involved;
    - (B) a description of the role, resources, and core skills and expertise provided by the network and involved organisations;
    - (C) a description of the CCS projects, outputs and contributions the network has completed or assisted in and current CCS project work;
    - (D) discussion on any of the practical limitations of the research and development work in terms of limited funding, resources, scope or relevance and applicability in other global contexts;
    - (E) a description of how these projects have or will contribute to the accelerated deployment of CCS technologies; and
    - (F) an outline of other relevant research and development activities the network and involved organisations are actively involved in;
  - (ii) conducting a launch meeting with a panel of CCS experts to identify organisations that are undertaking important R&D relevant to CCS;
  - (iii) providing case studies to illustrate lessons learnt through the analysis and best practice;
  - (iv) identifying and analysing any research and development gaps and developing recommendations to address these;
  - (v) identifying and recommending with supporting rationale research and development network projects that the Global CCS Institute should focus on for technical, regulatory, economic, political, geographical, public awareness, or other reasons; and
  - (vi) identifying and recommending with supporting rationale key performance indicators to allow the Global CCS Institute to evaluate and track its effectiveness in this area over time.
- (e) The **Final Report** will assess the gaps and barriers between current CCS projects and the deployment of multiple industrial-sized demonstration projects across the world. By synthesising the research of the Foundation Reports, this report will analyse the commercial and non-commercial gaps to the demonstration of large scale CCS projects and develop non-prescriptive strategies to address these. This will involve undertaking extensive analysis including but not limited to:

- (i) identifying key commercial and non-commercial (for example, skill development and capacity building, public awareness and understanding, safety, environmental issues, information sharing mechanisms) issues and gaps based on existing CCS demonstration projects using an expert panel and inputs from Report Coordinators;
  - (ii) using a range of overlays to analyse the identified issues such as technical, regulatory, economic, research, regional differences, information sharing mechanisms, capacity building and skill development, public awareness and understanding, safety and environmental factors;
  - (iii) comparing and analysing the difference in existing CCS demonstration project characteristics and the characteristics necessary to deploy industrial scale CCS demonstration projects today;
  - (iv) conducting a risk analysis (as a matrix of consequence versus probability), with supporting reasoning, to rank the importance of each issue;
  - (v) providing recommendations to address the issues. Recommendations are expected to:
    - (A) be presented as strategies and projects that should be implemented to address identified weaknesses, build off existing strengths, nullify threats, and realise opportunities;
    - (B) identify current CCS demonstration projects which Global CCS Institute should be supporting, the type of involvement required (monitor, personnel deployment, funding, etc) and the value of this activity to Global CCS Institute;
    - (C) reference the CCS demonstration deployment timetable announced by the G8 and demonstrate how the recommended strategies and projects will accelerate and impact upon this timetable;
  - (vi) identifying and recommending with supporting rationale key performance indicators to allow the Global CCS Institute to evaluate and track its effectiveness in addressing these issues over time;
- (f) In addition to the five Reports, the Contractor must submit an **Early Report** to RET (or the Global CCS Institute as the case may be) by 30 June 2009. The early report will include:
- (i) an overview of the status of all CCS demonstration projects including any barriers or challenges being experienced by existing projects;
  - (ii) a brief overview of any cost issues associated with CCS demonstration projects and how these have changed with the global financial crisis;
  - (iii) a brief overview of policy issues including any barriers and mechanisms to overcome these;

- (iv) a summary identifying and explaining the commercial and non-commercial gaps to the global deployment of large scale integrated CCS projects and strategies to address these; and
  - (v) collection of key issues and best practices identified to date.
- (g) In general, each of the Reports must be developed in two stages – Draft Version and Final Version. Each Draft Version Report will be peer reviewed and a report of findings developed. Each peer review report will:
- (i) provide a summary statement as to the accuracy, utility and relevance of the information contained in the report;
  - (ii) identify and describe, according to each section and where relevant each sub-section, the strengths and weakness of the information provided including:
    - (A) the information's accuracy (including the robustness of the models and methodologies used) and relevance;
    - (B) the level and rigour of the research and analysis undertaken and any recommendations and key performance indicators proposed; and
    - (C) the veracity of the references and links provided;
  - (iii) provide constructive suggestions as to how to address any weaknesses identified including the provision of actual content for inclusion into the report; and
  - (iv) be formally signed off by the peer reviewers.
- (h) The Contractor must provide a 60 minute PowerPoint presentation summarising the project, its key findings and recommendations. This will contain up to 60 slides and will contain a variety of graphs, charts, diagrams, tables as well as standard text and accompanying talking notes. The PowerPoint presentation will be submitted to RET (or the Global CCS Institute as the case may be) by 7 September 2009.

4. In the **third phase** of this project the Contractor must develop a **Close Out Report**.

### 3. Deliverables

This project will commence on 22 May 2009 and be completed by 30 September 2009.

	<b>Deliverables</b>	<b>Milestone Date</b>
1.	DRET engages & briefs the Contractor	22 May 2009
2.	Contractor submits detailed outline of each Foundation Report and Final Report to RET (or the Global CCS Institute as the case may be)	25 May 2009
3.	Contractor submits to RET (or the Global CCS Institute as the case may be) the Early Report.	30 June 2009

	<b>Deliverables</b>	<b>Milestone Date</b>
4.	Contractor submits to RET (or the Global CCS Institute as the case may be) the Draft Versions of the Foundation Reports including the CCS project database, the methodology for estimating costs and peer review reports.	20 July 2009
5.	Contractor submits to RET (or the Global CCS Institute as the case may be): <ul style="list-style-type: none"> <li>• the Final Version of the Foundation Reports including the CCS project database the methodology for estimating costs; and</li> <li>• the Draft Version of the Final Report (including peer review report).</li> </ul>	17 August 2009
6.	Contractor submits to DRET (or the Global CCS Institute as the case may be) the Final Version of the Final Report and the PowerPoint presentation summarising the project.	7 September 2009
7.	Contractor submits to DRET (or the Global CCS Institute as the case may be) the Close Out Report.	18 September 2009