CARBON SEQUESTRATION LEADERSHIP FORUM

CSLF-P-2004-4
8 December 2003

POLICY GROUP

REVIEW OF LEGAL, FINANCIAL AND REGULATORY ISSUES

Note by the Secretariat

Barbara N. McKee
Tel: +1 301 903 3820
Fax: +1 301 903 1591
CSLFSecretariat@hq.doe.gov

REVIEW OF LEGAL, FINANCIAL AND REGULATORY ISSUES

Note by the Secretariat

Background

At its inaugural meeting on 25 June 2003, the Policy Group of the Carbon Sequestration Leadership Forum decided that legal, financial and regulatory issues were of critical importance to the implementation of carbon sequestration throughout the world. A task Force chaired by Australia was organized to address these issues.

Since the inaugural meeting, Australia has been studying the legal and regulatory aspects of carbon sequestration and hosted an international Task Force meeting on the issue in early November 2003. Australia will present information on what it has learned on this topic at the meeting on 20 January 2004.

The Task Force on Legal and Regulatory Issues decided that the best approach to identify regulatory issues and gaps is to conduct various case studies. These case studies would be conducted for CO_2 Sequestration projects at different stages of development, sizes, technologies, and country sites. The Task Force has provided the Policy Group a letter proposal for consideration.

Action Requested

The Policy Group is requested to review and approve the letter proposal provided by Australia on Regulatory Issues.

Conclusions

The Policy Group is invited to note in the Minutes of its meeting of 21 January 2004 that:

> "The Policy Group approves the letter Proposal on Regulatory Issues presented by Australia for implementation."

CSLF-P-2004-4
December 8, 2003

CSLF
Carbon Sequestration Leadership Forum

LEGAL, REGULATORY & FINANCIAL ISSUES TASKFORCE

DRAFT DISCUSSION PAPER

Prepared by Australia
in consultation with other CSLF members
as a draft discussion paper for
Italy Policy Working Group Meeting
January 2004

TABLE OF CONTENTS

LEGAL, REGULATORY & FINANCIAL ISSUES TASKFORCE
DRAFT DISCUSSION PAPER

1.0 INTRODUCTION

At the inaugural meeting of the Carbon Sequestration Leadership Forum (CSLF) in June 2003, it was agreed that a Legal, Regulatory and Financial Issues Taskforce be established. Australia was nominated to take the lead on the Task Force and is to present a paper on these issues at the CSLF Policy Working Group meeting in Italy in January 2004. This document is a draft paper that Australia proposes to present at the CSLF Policy Working Group meeting in Italy in January 2004. The paper will consider legal, financial and regulatory issues associated with sequestration.

The regulation section of this paper has been prepared following the International Sequestration Regulatory Workshop, held in Brisbane, Australia, on 7 November 2003, which provided a starting point to commence work on regulatory issues. This section of the paper also incorporates input from some International Sequestration Regulatory Workshop participants. As such, the regulation section of the paper is the most advanced of the three issues and it is suggested that this section be considered as one approach for work on legal and financial issues. At the workshop on regulation, it was proposed that regulatory issues be resolved first and then further work on legal issues can then be progressed.

The paper has been developed for the consideration, comment and approval of all CSLF member countries, and it is hoped that all member countries will contribute to the finalisation of the paper. The overview of these legal, regulatory and financial issues do not necessarily represent the views of Australia but is designed to promote discussion to determine which issues should be given priority.

1.1 REGULATORY SECTION

One of the key priorities identified at the June 2003 CSLF meeting was the development of regulatory principles for sequestration, which could assist countries in developing their domestic regulatory regimes. Such standards or 'best practice guidelines' should be developed concurrently with the technical capacity for sequestration.

The assessment of key regulatory issues is based on a three-pronged approach; a literature review to identify and outline existing research and work on sequestration, a gap analysis to identify existing frameworks in place and also any gaps, and a case study approach, which will provide guidance on prioritisation of key issues where regulation is needed for sequestration. Once appropriate case studies have been identified, it is envisaged that project proponents will work together with the Legal, Regulatory and Financial Issues Taskforce to prepare three or four case studies in a similar format.

Regulatory Recommendations:

- All countries to provide to the Secretariat (and Australia for coordination) by 5 January 2004 with:
    - Comments on proposed draft work program
    - A list of relevant papers on regulatory issues
    - Comments on gap analysis and case study approaches
    - Gap Analysis responses
    - Nominated projects for case studies
    - Comments on template for case studies

1.2 LEGAL SECTION

The long term storage of CO_2 has been addressed directly by few conventions, protocols or laws. The issue is generally considered by existing legal instruments that focus on the subjects of waste and dumping. Most of these instruments were developed before long term CO_2 storage had been considered. As a result, the legal interpretation of how to address CO_2 storage issues is often blurred or inconsistent. It is important that this problem be addressed to facilitate the introduction of capture and storage technologies.

Legal Recommendations:

- Taskforce to liaise with the IEA Energy Technology Collaboration Division to discuss how the CSLF and the IEA might jointly progress the review of legal issues.
- Significant joint activities be presented to CSLF members for consideration through the CSLF Secretariat.
- CSLF members provide the Secretariat with details about legal issues which they believe should be addressed as a matter of priority.

1.3 FINANCIAL SECTION

The economic attractiveness of carbon sequestration is dependent on both project costs of sequestration and costs associated with a country's policy and regulatory environment. Understanding how these two elements interact within an economy will be important for countries that wish to develop climate change policies that allow for carbon sequestration to be an eligible and realistic mitigation option. Countries with expertise or an interest in the below work may wish to nominate to lead work on these issues.

Financial Recommendations:

- Discuss the range of financial elements relating to CCS, agree on how specific financial elements should be progressed, and develop a forward work-plan.
- Progress development of modelling on economic implications of CCS.
- Explore the balance of greenhouse insurance measures, regulations and financial mechanisms that impact on the attractiveness of sequestration.
- Encourage examination of the extent of opportunities for 'value-added' reservoirs'.
- Agree upon a standard set of cost inputs and data on timing issues.
- Support further work on the integration of top-down and bottom-up models where it relates to carbon capture and storage (CCS) technologies.
- Ensure appropriate sensitivity analysis is conducted on key drivers in the modelling and the impact these have on deployment of geosequestration technologies.
- Support further development of consistent and comprehensive modelling data and engage in discussions to agree on a consistent and where possible collaborative approach for future analysis.

2.0 REGULATION SECTION

2.1 INTRODUCTION

To assist in developing the regulation section of this paper Australia hosted an international sequestration regulatory workshop on 7 November 2003, in which 8 of the 15 CSLF member countries participated. The aim of the workshop was to discuss and agree on approaches and timeframes for addressing regulatory issues for recommendation to the January 2004 meeting. The outcomes of the workshop are reflected in this paper, which proposes an approach and timetable for addressing regulatory issues in the lead up to the CSLF Ministerial meeting in September 2004.

One of the key priorities identified at the June 2003 CSLF meeting was the development of regulatory principles for geosequestration. National regulatory arrangements will need to reflect internationally accepted standards for managing sequestration and these must be developed hand in hand with the technical capacity to deliver sequestration. Regulatory arrangements must also reflect and be responsive to international and domestic community attitudes.

An important first step in developing standards and guidelines for evaluating sequestration proposals is verifying the technical viability of sequestration sites and managing such sites during and after injection. There are also a number of international jurisdictional issues, such as the transport and storage of carbon dioxide under international waters and across national boundaries, which need to be addressed in order to facilitate sequestration projects.

The international sequestration regulatory workshop provided the opportunity for participating countries to discuss these areas and to an extent, compare their individual policy contexts and specific regulatory issues. The workshop agreed that members should build on this by identifying commonalities and gaps in their regulatory arrangements to aid the development of appropriate international guidelines. The participants of the workshop also noted that this would be an evolutionary process.

The approach outlined in this paper is intended to initiate that process and provide a structure for effective international collaboration. Specifically, the intention of this paper is to present:

- a framework for identifying and organising regulatory issues relating to sequestration, mainly geosequestration;
- an approach for identifying gaps in existing regulations for addressing these issues;
- a proposed work program for consideration for progressing regulatory issues at the Italy meeting.

2.2 WORK PROGRAM

A draft work program (Attachment 2-A) has been developed by Australia to be presented at the Italy Working group meetings. It is envisaged that CSLF member countries will take the lead on specific regulatory issues where expertise lie. The attached work program includes: this paper; literature survey of existing work; a regulatory gap analysis; case studies; and the key issue identification process. Australia expects that the attached work program will be discussed further in Italy with all CSLF member countries.

2.3 RESEARCH METHODOLOGY

The following proposed research methodology is a suggested approach only. The approach recommended by the workshop participants is only a starting point and other proposed methods and suggestions are welcomed. The approach recommended by the workshop participants has five key elements, as follows:

1. The preparation of this paper to outline an approach and work plan for progressing regulatory issues under the Legal, Regulatory and Financial Taskforce, as constituted under the auspices of the CSLF.

2. A literature survey of existing work on the regulation of geosequestration (Section 2.4). The workshop was mindful of the need to avoid duplicating work already done, but rather aim to consider and extend it. For instance, there has already been a lot of work done on the interaction of international conventions and treaties with offshore sequestration.

3. A regulatory gap analysis using a project life cycle approach, in combination with risk identification – to identify and organise issues, and provide a basis for identifying member countries' 'states of readiness' (Section 2.5). This paper provides a simple template for members to fill out, which will assist in identifying the gaps in existing regulatory regimes and alternative arrangements in member countries.

4. The use of case studies to identify, test and verify the issues identified in the gap analysis and applying them to real projects (Section 2.5). The case studies should encompass a range of geological and geographic conditions and different technologies in order to provide a comprehensive basis for the analysis and prioritisation of issues. An additional output from the case studies is the identification of knowledge gaps where greater understanding is needed before regulation can be drafted. This may lead to R&D needs that would feed into the CSLF Technical Group's program. The case studies may also provide a starting point for further studies to be commissioned by the CSLF.

5. The international regulatory workshop participants outlined some initial key issues. It is envisaged that as outcomes of the above processes, key issues facing CSLF member countries will be identified and clarified further. This key issue identification process has commenced at the workshop, but will be an ongoing process that will feed into from the gap analysis responses by member countries as well as the case studies. This will form the basis of agreed guidelines in September 2004.

2.4 WORK TO DATE ON SEQUESTRATION REGULATORY ISSUES

A number of organisations and countries have commenced work on considering regulatory issues relating to sequestration. In particular, the International Energy Agency (IEA) Gas R&D Program, the International Panel on Climate Change (IPCC), Norway, Canada, the United Kingdom and the CO_2 Capture Project have papers which are of relevance to regulatory considerations for the CSLF. A summary of some of the papers is provided in Attachment 2-B. It is recognised that the list of papers cited is a preliminary selection and there may be other existing relevant work for consideration by the Taskforce.

2.5 ASSESSMENT - GAP ANALYSIS AND CASE STUDY APPROACHES

The workshop identified the following research methodology and approaches to identify, assess and prioritise key issues relating to sequestration.

SELECTION OF GAP ANALYSIS

The regulatory workshop proposed a whole of project life approach to identifying regulatory mechanisms and issues. The following key stages in a sequestration project's life cycle were identified: capture; transport; injection; and post-closure. Within each of these stages the following key considerations were identified: event/risk (eg. CO_2 leakage); impact (eg. environmental damage); owner/responsible party (eg. operator/regulatory assessor); and the type of legislation/regulatory process in place, if any, to manage the risk in question. The structure of this analysis was in part selected to be consistent with other work being undertaken, such as by the IPCC, Canada and the United Kingdom.

The gap analysis will aim to identify and assess risks, evaluate consequences and attribute responsibilities at all stages of the project life. Analysis will also aim to highlight gaps in existing regulatory regimes and identify areas where information sharing and guidelines/ standards maybe useful for countries developing their own regulatory framework.

The workshop proposed that each member country carry out a gap analysis in this form, and provided a simple matrix for that purpose which is contained in Attachment 2-C. The purpose of the gap analysis is three-fold:

(i) to start member countries thinking about these issues, if they have not done so already;

(ii) to provide information on countries summary 'picture' of the sequestration preparedness of countries and where the main gaps lie; and

(iii) to identify alternative regulatory approaches for all members' information and consideration when developing their own regulatory regime.

Australia has completed a gap analysis table which may provide guidance (Attachment 2-D). In compiling this example table, specific steps and issues have been identified which are key to current Australian projects and as such, the table is not intended to comprise a complete list of the issues which may arise. This draft gap analysis is a preliminary suggestion only, and is not intended to anticipate what other countries may wish to include.

To fill out the gap analysis table, all relevant steps and considerations relating to each phase of the project life cycle should be identified. These issues will need to be briefly outlined in terms of the impact of each, potential ownership and liability issues and identification of whether there is any existing regulation in place to address each step. It is not necessary to specifically mention the name of legislation, but rather identify the field of regulation which operates in relation to each event.

Capture

The workshop identified that the capture phase may incorporate a variety of new technologies, arising from the nature of the project and the source of the carbon dioxide (e.g. what level of impurities are acceptable). At this stage of the cycle, activities relating to project initiation and application, site assessment and development of injection wells would be undertaken. Relevant regulatory considerations may include the development of appropriate methods and processes to prevent risks including leakage, definitions and standards for carbon dioxide and other materials,

permits and licensing, health and safety regulations, ownership, liability, environmental standards and matching appropriate locations in terms of source, transmission and sink.

Transport
The transport phase is defined to be from the separation plant to the injection site. This may include transportation by pipeline, truck, ship or some other means. Issues relating to transport may include surface engineering standards, ownership, property rights, liability, health and safety, methods and process to prevent risks including leakage and third parties' rights and obligations relating to transportation.

Injection
The injection phase of the project cycle covers all activities relating to the injection of carbon dioxide into the subsurface. Issues relating to subsurface integrity, engineering and liability will become a focus in this period. The workshop identified further issues including health and safety, risk assessment methods and processes, monitoring and verification, permits and licensing, environmental assessments and standards and subsurface engineering standards.

Post-closure
The closure and post-closure phase of the project will involve a variety of issues relating to abandonment, rehabilitation and may include transfer of liability from the proponent to government. Long term liability is a key issue in this phase and length of monitoring may also be a consideration. The workshop identified that possible issues to consider include monitoring and verification, health and safety, rehabilitation, environmental assessments and ownership and liability.

SELECTION OF CASE STUDIES MATRIX
It was proposed at the international regulatory workshop that a number of case studies be used to explore and test sequestration regulatory issues in more detail, also using the project cycle and risk framework described above. It was suggested that approximately six case studies be nominated prior to Italy and then from these, three or four case studies would be chosen by the Legal, Regulatory and Financial Issues Taskforce. The findings from the case studies would inform the development of regulatory principles that could be agreed at the next CSLF Ministerial meeting in September 2004.

The selection of case studies will ultimately be up to the discretion of the Taskforce. However, the regulatory workshop participants outlined a number of key components they felt necessary for a full spectrum of issues to be covered. As such, the attached matrix (Attachment 2-E) was designed in order to facilitate the selection of suitable case study examples.

It was thought that case studies should be balanced as much as possible between: demonstration and commercial projects; oil and gas and coal projects; cross-jurisdictional and onshore/ offshore issues; be sited in different member countries; and should be live projects. The attached matrix aims to highlight differences between projects across the CSLF member countries to enable the selection of three case studies which will illustrate the range of regulatory issues. It is anticipated that while the case studies will not cover every potential situation, they will be applicable to a variety of situations. The matrix shows the projects: Katuma; Snohvit; Sleipner; Nagaoka; Weyburn; and Frio as examples. These examples have been chosen because they all

differ amongst the categories in the matrix and are all reasonably close to commencing if they have not already.

Project Scale & CO_2 Injection Rate
The first aspect of the matrix looks at the scale of the project: demonstration; research; commercial; and semi-commercial. The CO_2 injection rate for each project is also highlighted to determine the size of the project. It is classified in terms of small, medium and large; with small-scale CO_2 injection being under ten thousand tonnes per annum, medium-scale between ten thousand and one million tonnes per annum (mtpa) and large-scale injection rates is anything over one mtpa. A mix of size, capacity, and application to other projects is considered necessary to reap the full realm of regulatory issues.

Location & Jurisdiction Area
The regulatory workshop participants discussed the need for projects to be in different locations to raise a variety of regulatory issues. It was decided that the three case studies should be located in different countries with the capture and injection of CO_2 being a mixture of onshore and offshore, as this will also ensure a mix of jurisdictional areas.

Project Stage
It was also discussed at the regulatory workshop that each of the case studies should be 'live' projects, and should be a mix of projects in both the early and advanced stages. The length of the project is also outlined in the matrix, to ensure that projects are currently, or will shortly be underway, as this will show that any regulations developed would be relevant in the current timeframes.

CO_2 Capture & Transportation
Workshop participants thought that the case studies should focus more on storage, as this is where most of the new regulation is required. As such, for the purposes of the matrix, CO_2 capture has been spilt broadly between industrial and extraction. Industrial capture includes capture from the flue gas approach, oxygen combustion approach, and any power station or cement factories, whereas extraction refers to approaches, such as enhanced oil recovery processes and acid gas re-injection. CO_2 transportation is split into three broad categories: pipeline; ship and truck. Whilst a mix of these is desired, it is not as imperative as other aspects of the matrix.

CO_2 Storage
This section of the matrix has been split into geological, ocean and terrestrial ecosystems storage. The CSLF has focused on geological storage formations so far, as this is where the most advanced work has taken place. Geological formations can include: oil and gas reservoirs; deep saline aquifers; deep unminable coal beds and mineralisation. It is envisaged that case studies will focus on this section.

Willingness
Project proponents must be prepared to work with the CSLF, as without the proponent's cooperation, research and data gathering for the purpose of the case study would be difficult. Key organisations involved in the project are also of interest, as these organisations may be able to assist proponents in the research for the case study. It is envisaged that government in the relevant countries would be responsible for preparing the case study.

TEMPLATE FOR CASE STUDIES

Once appropriate case studies have been identified, it is proposed that project proponents will work together with the Legal, Regulatory and Financial Issues Taskforce to prepare case studies in a similar format. To facilitate this approach, a template has been drafted in Attachment 2-F. The template is a starting point intended to initiate discussion and comment.

The first section of the case study will be general information and description of the project, such as: project location; time frame; organisations involved; type of project; CO_2 injection rate and the organisations involved. It is then envisaged that the case study will give more specific details on the regulation surrounding the capture, transport, injection and storage of the CO_2.

For the purposes of the case study, it is not deemed necessary to go into great detail on domestic legislation, such as specific Acts. However, a basic description of who owns the CO_2 at the various stages, who controls it and who regulates it would be useful information for the Taskforce in identifying relevant sequestration regulatory issues. The template also requires detail on existing legislation that either covers CO_2 or whether the project can identify appropriate legislation that may be modified.

The final section of the case study template looks to address any international aspects of the project, namely whether the project takes into account any treaties and it also seeks information on any relevant treaties and international obligations.

2.6 RECOMMENDATIONS AND WAY FORWARD

A draft timeframe of the key objectives and desired outcomes for the identification of sequestration regulatory issues is outlined below and in Attachment 2-G. Its main elements are:

Work Program

A draft work program will be developed by Australia in time to be presented at Italy and it is envisaged that member countries will take the lead on specific regulatory issues where expertise lie.

Key Issues Identification

At the international sequestration regulatory workshop, participants identified a number of issues. General, overarching issues that were identified included flexibility in research and development in demonstration and pilot projects; and existing versus new alternative regulation. Key regulatory issues were identified by workshop participants, under four key stages: capture; transport; injection; and post-closure. Under the capture phase issues identified included: systems analysis (ownership, safety, ecology & integrity); site-selection criteria (risks i.e. slow versus large-scale leakage); environment assessment and standards; facility siting & permits; location & matching (source/ transmission/ sink); ownership & property rights; and liability.

Working Group Meetings - Pisa, January 2004

Australia will present this draft paper on the Legal, Regulatory & Financial Issues to the Policy Working Group in January 2004. The framework assessment for the paper will aim to: identify & assess risks; evaluate consequences; and attribute responsibility. Attached to this paper is a blank 'gap analysis' table for which Australia has requested the input of other member countries by 5 January 2004, in time to present the findings

in Italy. To aid the input to this table, Australia has prepared an example gap analysis, addressing Australian domestic regulation and sequestration regulatory gaps.
We understand the blank table and the subsequent Australian example will be circulated with this paper on 10 December by the CSLF Secretariat along with other papers for the Italy Working Group meetings. Australia aims to gain agreement on the proposed way forward for the Legal, Regulatory & Financial Issues Taskforce, specifically the gap analysis case study approaches.

It is also hoped that as an outcome of the Italy meetings that three appropriate case studies can be identified and agreed upon by CSLF member countries. Once appropriate case studies have been identified in January 2004, it is envisaged that project proponents will work together to prepare case studies in a consistent format. Australia aims to have these case studies finalised in time for the proposed second Working Group meetings in mid-2004.

Potential Working Group Meetings - May/ June 2004
It is still uncertain if another working group meeting will take place before the second ministerial level meeting in Australia in September, however it is hoped that such a meeting will take place, in order to finalise case studies and decide on the taskforces objectives and aims for the CSLF Ministerial meeting in Melbourne in September 2004. It is anticipated that a more specific work program will be developed by this time.

2nd CSLF Meeting- Melbourne, September 2004
The second Ministerial level meeting for the CSLF will aim to finalise and agree upon both technical and policy roadmaps and it is envisaged that key regulatory issues that have been identified will feed into these processes. By September 2004, it is hoped that there will be agreement on key regulatory issues and if possible principles.

International Regulatory Best Practice Principles
In the longer term, an objective of the taskforce for Legal, Regulatory and Financial Issues Taskforce is to agree upon a set of regulatory principles for sequestration. It is also envisaged that this framework will work with other for a, such as the IEA to reduce some of the current uncertainties with relevant international conventions, such as the London Convention. More specific objectives and aims for these final goals of the taskforce will be developed as key issues are identified through the gap analysis and case study approaches.

Attachment 2-A – Proposed Regulatory Draft Work Program

KEY WORK PROCESSES	LEAD MEMBER NATION (S)	OTHER NATIONS/ KEY ORGANISATIONS WHO COULD ASSIST	PROPOSED OBJECTIVES/ DESIRED OUTCOMES	PROPOSED OUTPUT
PROPOSED WAY FORWARD				
Draft Regulatory Paper	*Australia*	*US, UK, Japan, Canada & China*	*Outline of proposed way forward for Taskforce*	*Presentation of Paper at Italy*
LINKING INTO RELEVANT WORK				
Survey of Existing Reports to date	*Australia*	*All countries*	*Understand & work from existing studies*	*Summary presented at Italy*
Canada to provide update on second domestic regulatory study	*Canada*	*Canada*	*Understand & work from existing studies*	*Update on progress at Italy*
IEA update on on-going work	*UK & US*	*IEA*	*Understand & work from existing studies*	
CO_2 Capture Project- update on on-going work	*Australia*	*UK, US & Canada*	*Understand & work from existing studies*	
IPCC- update on on-going work	*Australia*	*IPCC*	*Understand & work from existing studies*	
REGULATORY GAP ANALYSIS				
Gap Analysis Table	*All countries*	*Australia to provide an example*	*Input from all countries by 5 January 2004*	*- Presentation of outcomes at Italy* *- Finalisation by May/ June*
CASE STUDIES				
- Template for Case Studies	*Australia*	*All countries*	*Case studies to be written in consistent way*	*Finalisation by Italy*
- Potential Case Study 1	*Country of project location*	*Project proponent& relevant agencies*	*Identify key issues & knowledge gaps*	*Finalisation by May/ June*
- Potential Case Study 2				
- Potential Case Study 3				
KEY ISSUE IDENTIFICATION				
Capture	*TBD*			*Update by May/ June* *Finalisation by Melbourne*
Transport	*TBD*			
Injection	*TBD*			
Post-closure	*TBD*			

Attachment 2-B – Regulatory & Legal Literature Review Summaries

(1) 'Legal Aspects of Underground CO_2 Storage', Fridtjof Nansen Institute, 2001

This paper was commissioned by Statoil as part of the CO_2 Capture Project, in response to accusations that injecting CO_2 as part of the Sleipner West project can be considered to be dumping of 'industrial waste'. The paper summarises developments under the London Convention, the OSPAR Convention and the North Sea Conference.

The paper found that disposal or storage of wastes or other matter from offshore oil and gas activities is not covered by the London Convention, so injection of CO_2 from offshore installations to sub-seabed formations or into the sea is not covered.

Some of the main findings of the report are as follows. The London Convention is the most relevant forum for a regulatory framework for CO_2 storage. It does not currently explicitly cover CO_2 storage but is likely to address this issue in the future. There are differing views between nations as to how 'urgent' the issue is, and this will impact on the timing of when the issue will be addressed. There are also differing views between nations about the legal status of CO_2 storage in relation to dumping and classifications of 'industrial waste'. The issue of CO_2 storage has so far mainly been addressed in relation to ocean rather than underground storage, and negative consequences associated with ocean storage may flow onto underground storage.

(2) Legal and policy aspects: impact on the development of CO_2 storage, WJ Lenstra and BCW van Engelenburg, Ministry of Environment, The Netherlands, 2002

This paper was prepared for the Intergovernmental Panel on Climate Change (IPCC) Working Group III: Mitigation of Climate Change, Workshop on Carbon Dioxide Capture and Storage held in Canada in November 2002. The paper discusses legislation in three areas: international law, European directives and national legislation.

On international law it finds that the main issue is whether CO_2 storage falls under the jurisdiction of the treaties or conventions – the London Convention, the United Nations Convention on the Law of the Sea (UNCLOS), the Paris Convention, OSPAR and the North Sea Conference. Other questions are:

- Should CO_2 be classified as an industrial waste?
- Which body has or should have jurisdiction?
- What are the practical consequences of that possible jurisdiction?
- Where does the ocean/ sea end and the deep underground begin?
- Whose is the CO_2 once it is stored?

The paper concludes that nothing is clear yet, and there is no consensus about the answers to these questions, but that the treaties can become a show-stopper for CO_2 capture and storage (CCS).

On European directives, the paper finds that there are a few directives which can influence national legislation: waste materials, dumping of waste materials, and water. Work by the Dutch Government found that CO_2 falls under jurisdiction of the directive of waste materials, but it is not a dangerous waste material, and injection of CO_2 in the deep underground does not fall under the jurisdiction of the directive on dumping of waste materials.

The discussion about interpretation of the directives will be carried out by national governments, which could mean there are different outcomes for each EU country.

On national legislation, the paper made the following points:

- CCS is not yet included in national legislation; if CCS is related to an existing practice, eg EOR, the legal position is more clear;
- An environmental impact assessment should be carried out for a CCS project;
- CCS is a new technology with its own risks, need to prove that no 'irreparable harm' will result;
- a CCS project will have to deal with a large variety of 'official' bodies, including federal and local governments and interest groups;
- a CCS project mostly has two parts: above ground, which is very likely covered by present legislation, and below ground.

Managing the risks is the most important part of a CCS project. This requires a reliable process for monitoring and verification, which will in turn assist in 'earning' a licence to operate.

(3) Developing Recommendations for the Management of Geologic Storage of CO_2 in Canada, David Keith and Malcolm Wilson, 2002

This report was commissioned by Environment Canada, Saskatchewan Industry and Resources, Alberta Environment and British Columbia Energy and Mines.

It identifies the "crucial issues to be resolved and recommends procedures that will enable regulators to ensure subsurface storage of CO_2". Risk of CO_2 storage should be evaluated in the local and global context.

Recommendations arising from this paper outline that:

- A large-scale project needs to be implemented to decrease uncertainty about CO_2 storage.
- Regulatory protocols[1] should serve two purposes including to achieve the acceptability of safe storage and to maximise the ability to learn through experience.
- Regulatory protocols should allow for incorporation of new knowledge as it emerges. Protocols should not be prescriptive or limiting and should allow for retrospective change following triggering conditions.
- There should be a balance of public availability of data vs. company intellectual property rights. The authors recognise that releasing information could be a problem due to competitive disadvantages. In addition, if a leak is identified, it could result in regulatory intervention.
- Sufficient flexibility is required for dealing with change in knowledge, effective management and accommodating diversity in scale/ geological setting.
- Regulation should reflect the scale and needs of projects and should be performance based.
- Management should be transparent as CO_2 sequestration projects are high in profile.
- Any public processes should aim to be objective, transparent and open to input. The process should also be able to deliver 'closure' in the form of definitive answers within a reasonable timeframe.

[1] Regulatory Protocols refers to objective based, rather than prescriptive regulations.

- It is the author's opinion that responsibility lies with government at the abandonment of the project. Require clear/ orderly method of transfer of liability.

(4) Review of the Feasibility of Carbon Dioxide Capture and Storage in the UK, UK Department of Trade and Industry, 2003

On international regulation, the paper finds that EOR is permitted, and sequestration from certain pipelines originating from land appear not to be prohibited under the London and OSPAR Conventions. However, these treaties preclude the use of existing offshore installations for sequestration without EOR. Further, the paper concludes that the process of amendment of these treaties would probably take several years and would take international agreement. Both the London and OSPAR Conventions place the obligation on national governments to establish strict regimes for authorisation and regulation of activities which affect marine eco-systems.

The paper identifies areas of work which are needed, including on legal and regulatory issues, which is defined to be the clarification or amendment of the London and OSPAR Conventions, particularly gaining the agreement of other Parties to the Conventions, i.e. national governments. The paper finds that it is essential that authorisation and regulatory frameworks are established in collaboration with other Contracting Parties, and recommends that the UK take the lead to establish international collaboration on this. The paper also recommends that work should address the regulatory requirements, particularly for transport and storage, and that storage regulations should be developed in collaboration with other countries around the North Sea rim.

Further studies which the Taskforce needs may like to consider include:

(5) Inventory and review of government and institutional policies and incentives contributing to CO_2 capture and geological storage, ERM, 2003

This report was commissioned by the CO_2 Capture Project and written by ERM consultants.

(6) IEA Greenhouse Gas R&D Programme, Review of International Conventions Having Implications for the Storage of CO_2 in the Ocean and Beneath the Seabed, 2003

This report is summarised in the legal section of this paper.

(7) Intergovernmental Panel on Climate Change Special Report on Carbon Dioxide Capture and Storage

The IPCC is preparing a report on geological and oceanic carbon separation, capture and storage, which should be completed in the first half of 2005. The report includes sections on the legal aspects of geological storage, transport and ocean storage, including national legislation and international treaties and conventions. It is also looking at greenhouse gas emission inventories and accounting issues.

The Special Report is due in early to mid 2005. The Technical Working Group is currently looking at the work of the IPCC. Australia is checking with the IPCC whether there may be an opportunity for individual government's to review a late draft of the report at the end of 2004.

Attachment 2-C – Regulatory Gap Analysis Table

	EVENT	IMPACT	OWNER	EXISTING REGULATION
Capture				
Transport				
Injection				
Post-closure				

Attachment 2-D – Australian Regulatory Gap Analysis Table

	EVENT/RISK	IMPACT	OWNER	EXISTING REGULATION (or potential scope for expansion)
CAPTURE				
	• *Risk management* - *Leakage* - *Separation integrity* - *Engineering integrity* - *Plant safety* - *Site assessment and approvals* - *Environmental assessments*	*Safety* *Environment*	*Operator* *Assessor*	• *Occupational Health and Safety legislation* • *Environment Legislation* • *Petroleum legislation* • *Mineral resources legislation* • *Dangerous goods legislation* • *Coal mining safety and health legislation*
	• *Standards:* - *Classification of CO2* - *Allowable concentrations of other materials* - *Permits and licensing* - *Conditions of access*	*Land access* *Ownership* *Third party access* *Environment*	*N/A*	• *Petroleum legislation* • *Environment legislation* • *Offshore activities legislation* • *Land lease legislation* • *Land administration legislation* • *Explosives and dangerous goods legislation* • *Mineral resources legislation*
	• *Property rights and liability*	*Third parties* *Operator* *Contractor* *Community at large*	*N/A*	• *Pipeline legislation* • *Petroleum legislation* • *Mineral resources legislation* • *Occupational health and safety legislation* • *Environment legislation*
TRANSPORT				
	• *Risk management* - *Leakage* - *Engineering integrity* - *Health and safety - transport* - *Environmental assessments*	*Safety* *Environment*	*Owner* *Contractor – if stipulated*	• *Pipelines legislation* • *Explosives and dangerous goods legislation*
	• *Standards:* - *Allowance of transportation in pre-existing gas or fuel pipelines* - *Planning for new pipelines* - *Permits and licensing* - *Land access* - *Third party access* - *Pipeline integrity* - *Monitoring and verification*	*Safety* *Environment*	*N/A*	• *Pipelines legislation* • *Land administration legislation* • *Explosives and dangerous goods legislation* • *Environment legislation* • *Occupational health and safety legislation*
	• *Property rights and liability* - *Cross-jurisdictional issues*	*Third parties* *Operator* *Contractor* *Community at large*	*N/A*	• *Pipeline legislation* • *Petroleum legislation* • *Mineral resources legislation* • *Occupational health and safety legislation* • *Environment legislation*

	EVENT/RISK	IMPACT	OWNER	EXISTING REGULATION (or potential scope for expansion)
INJECTION				
	• *Risk management* - *Leakage* - *Engineering integrity* - *Health and safety* - *Environmental assessments* - *Sub-surface integrity* - *Surface integrity*	*Safety* *Environment*	*Owner* *Operator* *Contractor*	• *Land administration legislation* • *Explosives and dangerous goods legislation* • *Petroleum safety legislation* • *Pipelines legislation* • *Mineral resources development legislation* • *Occupational health and safety legislation* • *Planning legislation* • *Coal mining safety legislation*
	• *Standards:* - *Pipeline integrity* - *Planning for new pipelines* - *Permits and licensing* - *Land access* - *Third party access* - *Monitoring and verification* - *Site selection* - *Environmental assessment* - *Injection point* - *Location matching – source and sink* - *Storage system integrity*	*Safety* *Environment*	*N/A*	• *Land administration legislation* • *Land lease legislation* • *Explosives and dangerous goods legislation* • *Petroleum safety legislation* • *Pipelines legislation* • *Mineral resources development legislation* • *Occupational health and safety legislation* • *Planning legislation* • *Coal mining safety legislation*
	• *Property rights and liability* - *Cross-jurisdictional issues* - *Surface rights* - *Sub-surface rights* - *Compensation rights* - *Long term-v-short term liability*	*Safety* *Environment*	*N/A*	• *Pipeline legislation* • *Petroleum legislation* • *Mineral resources legislation* • *Occupational health and safety legislation* • *Environment legislation*
POST-CLOSURE				
	• *Risk management* - *Leakage* - *Engineering integrity* - *Health and safety* - *Environmental assessments* - *Sub-surface integrity* - *Surface integrity*	*Safety* *Environment*	*Owner* *Operator* *Contractor* *Public Liability issues*	• *Land administration legislation* • *Explosives and dangerous goods legislation* • *Petroleum safety legislation* • *Pipelines legislation* • *Mineral resources development legislation* • *Occupational health and safety legislation* • *Coal mining safety legislation*
	• *Standards:* - *Permits and licensing* - *Land access* - *Third party access* - *Monitoring and verification* - *Environmental assessment* - *Storage system integrity*	*Safety* *Environment*	*N/A*	• *Land administration legislation* • *Explosives and dangerous goods legislation* • *Petroleum safety legislation* • *Pipelines legislation* • *Mineral resources development legislation* • *Occupational health and safety legislation* • *Coal mining safety legislation*
	• *Property rights and liability* - *Cross-jurisdictional issues* - *Surface rights* - *Sub-surface rights* - *Compensation rights* - *Long term-v-short term liability*	*Safety* *Environment*	*N/A*	• *Pipeline legislation* • *Petroleum legislation* • *Mineral resources legislation* • *Occupational health and safety legislation* *Environment legislation*

Attachment 2-E – Draft matrix for selection of case studies

	Katuma Example	*Sleipner Example*	*Weyburn Example*	*Nagaoka Example*	*Frio Example*	*Snohvit Example*
PROJECT SCALE						
▪ **Demonstration** ▪ **Research** ▪ **Commercial**	*Commercial/ R&D*	*Commercial/ R&D*	*Commercial*	*Demonstration*	*Demonstration*	*Commercial*
CO_2 INJECTION RATE						
▪ **Large** ▪ **Medium** ▪ **Small**	*Large 11 Mtpa*	*Large 1 Mtpa*	*Large 1 Mtpa*	*Small 10,000 tonnes over 18 mths*	*Small 3750 tonnes*	*Medium 700,000 tpa*
LOCATION OF PROJECT						
▪ **Country**	*Indonesia (run by Japan)*	*Norway*	*Canada*	*Japan*	*United States*	*Norway*
▪ **Capture: Onshore/ offshore**	*TBC*	*Offshore*	*Onshore*	*Onshore*	*Onshore*	*Onshore*
▪ **Injection: Onshore/ offshore**	*TBC*	*Offshore*	*Onshore*	*Onshore*	*Onshore*	*Offshore*
JURISDICTION AREA						
▪ **Cross- jurisdictional** ▪ **Trans- jurisdictional**	*TBC*	*Nil- within Norway's waters*	*Trans (From US)*	*Nil- within one prefecture*	*Nil- within one state*	*Nil- within Norway's waters*
PROJECT STAGE/ STATUS						
▪ **Yet to begin** ▪ **Commenced**	*Yet to begin*	*Commenced*	*Commenced*	*Commenced*	*Yet to begin*	*Yet to begin*
▪ **Project Length: Start & end date**	*Start- 2006 Finish - TBC*	*Start-1998 Finish-2002*	*Start-2000 Finish-2020*	*Start-2003 Finish-2005*	*Start-2005 Finish- 2006*	*Start- 2005 Finish-2035*
CO_2 CAPTURE						
▪ **Industrial** ▪ **Extraction** ▪ **Purchased**	*Extraction*	*Extraction*	*Industrial*	*Purchased in market*	*Industrial*	*Extraction*
CO_2 TRANSPORT						
▪ **Pipeline** ▪ **Ship** ▪ **Truck**	*Pipeline*	*Pipeline*	*Pipeline*	*Truck*	*Truck*	*Pipeline*
CO_2 STORAGE						
▪ **Oil & gas reservoirs** ▪ **Deep saline formations** ▪ **Deep unminable coalbeds** ▪ **Mineralisation**	*Oil Reservoir*	*Saline Aquifer Depth 1 km*	*Oil reservoir*	*Saline Aquifer Depth 1.1 km In gas field*	*Gas Reservoir*	*Reservoir under seabed*
CASE STUDY FESABILITY						
▪ **Proponent willing to cooperate with CSLF?**	*TBC*	*TBC*	*TBC*	*TBC*	*TBC*	*TBC*
▪ **Key organisations involved**	*Mitsubishi Heavy Industries, Nissho Iwai Corp and Kansai Electric Power Co*	- *Statoil*	- *IEA* - *EnCana* - *Dakota Gasification Company*	- *RITE(METI)* - *ENAA* - *SEC* - *Teikoku Oil Co. Ltd.*	- *US DOE*	- *Statoil*

Attachment 2-F – Draft Case Study Template (Regulatory & Legal Issues)[2]

1.0 PROJECT DESCRIPTION

The first section of the case study will be general information and description of the project, such as:

- Project location;
- Time frame;
- Type of project eg. CO_2 source;
- CO_2 injection rate; and
- Organisations involved.

2.0 CO_2 CLASSIFICATION

- Is CO_2 already classified?
- For the purposes of the project, how is CO_2 classified?
- What level of impurities are allowed for it still to be classified as CO_2?

3.0 CAPTURE OF CO_2

- Is there existing legislation?
- Is there relevant legislation that could be modified?
- Who owns it?
- Who controls it?
- Who regulates it?

4.0 TRANSPORT OF CO_2

- Is there existing legislation?
- Is there relevant legislation that could be modified?
- Who owns it?
- Who controls it?
- Who regulates it?

5.0 INJECTION OF CO_2

- Is there existing legislation?
- Is there relevant legislation that could be modified?
- Who owns it?
- Who controls it?
- Who regulates it?

6.0 STORAGE OF CO_2

- Is there existing legislation?
- Is there relevant legislation that could be modified?
- Who owns it?
- Who controls it?
- Who regulates it?
- How are storage sites selected?
- Who is liable for CO_2 release if the storage site proves to be unsuitable?
- Who is responsible for monitoring the CO_2?

7.0 POST-CLOSURE

- Is there existing legislation?
- Is there relevant legislation that could be modified?
- Who owns it? Is there a title transfer? (Liability issues)
- Who would be responsible for monitoring CO_2 and maintaining well structures in the long term to avoid leakage in storage regions?

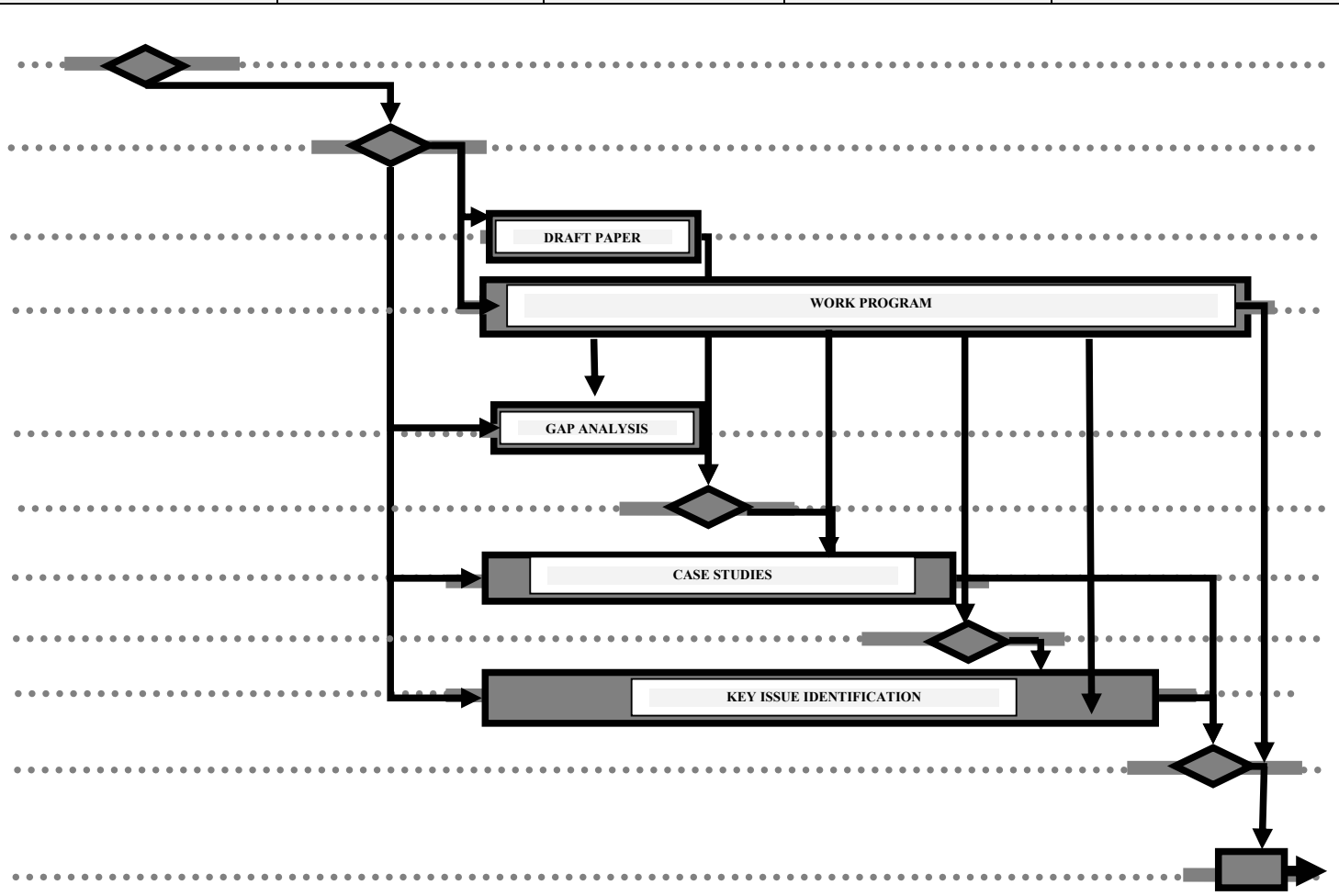
7.0 INTERNATIONAL ASPECTS

- Explain how the project takes account of international treaties and conventions.
- Identify relevant treaties and international obligations and how these are translated into national law.
- How would liability due to below ground movement of CO_2 across international borders be addressed?

[2] Financial issues and components of template may be developed and incorporated at a later stage

Attachment 2-G – Draft Timeframe of Key Outcomes on Regulatory Issues

	WASHINGTON, UNITED STATES JUNE 2003	BRISBANE, AUSTRALIA NOVEMBER 2003	PISA, ITALY JANUARY 2004	POTENTIAL WORKING GROUP MEETING MAY/ JUNE 2004	MELBOURNE, AUSTRALIA SEPTEMBER 2004
CSLF INAUGURAL MEETING - Legal, Regulatory and Financial Issues Taskforce concept agreed - Australia nominated to lead					
REGULATORY WORKSHOP - Gap Analysis & case study approaches identified					
REGULATORY ISSUES PAPER - Australia to prepare paper - Draft paper presented at Italy					
WORK PROGRAM - Member countries to lead on specific issues					
GAP ANALYSIS TABLE - Australia to prepare example - Table circulated on 10 December 2003 by CSLF Secretariat - Input by member countries to Australia by 5 January 2004					
POTENTIAL WORKING GROUP MEETING					
CASE STUDIES - Agree on 3 projects at Italy - Case Studies developed further					
WORKING GROUP MEETING - Finalise case studies					
KEY ISSUES IDENTIFIED					
2nd CSLF MINISTERIAL MEETING - Agreed regulatory principles - Finalise & agree upon roadmaps					
INTERNATIONAL REGULATORY GUIDELINES - Agreed regulatory guidelines - Information sharing conclusion					



LEGAL, REGULATORY & FINANCIAL ISSUES TASKFORCE
DRAFT DISCUSSION PAPER

3.0 LEGAL SECTION

3.1 INTRODUCTION

The purpose of this section is to outline:

- the breadth of legal issues that may require consideration by CSLF members;
- current work on legal issues that is relevant to carbon dioxide capture and storage; and
- a proposal on how to proceed on legal issues recognising that other organisations are examining this area in depth.[3]

3.2 WORK TO DATE ON LEGAL ISSUES

The following sections raise questions that are relevant to the introduction of CO_2 capture and storage technologies and may require consideration from a legal perspective. The objective of this discussion is not to resolve the issues but to provide an indication of matters that may be encountered.

Is the CO_2 Stored or Disposed Of?

If the injected CO_2 is classified as being stored, it could be assumed that the entity with access rights to the storage site will take possession of the gas when the site is sold or the site lease expires. If the CO_2 is not recovered at the expiry of a lease, should it be assumed that it has been disposed of? If not, what entity owns the CO_2?

The issue of storage versus disposal is considered in more detail in a later discussion on a recent IEA Report.

Inconsistent Treatment of CO_2 Disposal Under Conventions / Protocols / Directives

The national implementation of the directives and conventions are often by national law which can lead to a divergence in the implementation of the directives. Capture and storage activities were not envisaged when many of these directives and subsequent national laws were made.

For example, EU directives that could be relevant to CO_2 capture and disposal include:

- the framework directive on waste materials (75/442/EEG);
- the directive on the dumping of waste materials (1999/31/EG); and
- the framework directive on water (2000/60/EG).

A Dutch legal taskforce has concluded that:

- CO_2 is under the jurisdiction of the directive on waste materials;
- CO_2 is not a dangerous waste material;
- CO_2 deep underground is not under the jurisdiction of the directive on dumping of waste materials[4]

However other EU countries could interpret the directives differently when implementing national legislation on CO_2 capture and storage.

---

3 Note that regulatory issues will be considered first and then legal issues.

[4] Lenstra, WJ and van Engelenburg, BCW (2002), *Legal and Policy Aspects: Impact on the development of CO_2 Storage* (2002) A paper presented at the IPCC workshop on CO_2 capture and storage.

This highlights the need to discuss a consistent approach to capture and storage activities both within the EU and more broadly.

Choice of Storage Site
How would a suitable storage or disposal site be defined and should a consistent approach be adopted internationally to address the issue of:

- sites under international waters; and
- sites that straddle either national boundaries or national boundaries and international waters?

Would the definition of a suitable site only refer to performance of the site (eg maximum leakage rate per annum[5]) or would it incorporate details about:

- the suitability of the region's geology and hydrodynamics;
- the likely migration pattern and speed of the CO_2;
- the potential impact on nearby coal, hydrocarbon, water and other resources; and
- the maximum safe storage capacity and maximum rate of injection.

When determining site suitability should the site be independently assessed?

Established Storage Site Unsuitable
Who is liable following CO_2 leakage where the selected site does not meet the needs of the CO_2 injector (eg site storage capacity and rate of injection are insufficient)?

This question becomes complex where:

- a site is used by multiple injectors (possibly from different countries);
- the site is under international waters or straddles national borders; or
- a third party assumes responsibility for collecting and injecting the CO_2 from emitters.

Site Found to Be Unsuitable or Inadequate Long After Establishment
Improvements in science, better monitoring technology and enhanced knowledge about a specific storage site may prove that a site once considered suitable is subsequently found to be unsuitable or adequate only with substantial additional cost being incurred.

Losses could include:

- financial costs to compensate for releasing CO_2 (which could be substantial under emissions trading systems where emissions have been stored for decades); and
- the cost of establishing alternative storage arrangements.

Should the risk of this occurring be considered as being part of normal commercial risk? In what circumstances would the site assessor be liable for financial losses?

[5] However note that this approach may not be feasible because monitoring surface leaks over background CO_2 has not been demonstrated for large scale demonstrations (Wilson, EJ and Keith DW *Geologic Carbon Storage: Understanding the Rules of the Underground.* A paper presented at the 6th International Conference on Greenhouse Gas Control Technologies 2002).

Monitoring and Verification for Operational Sites
What arrangements should be made for the long term monitoring of a site where CO_2 has been injected? While the entity responsible for injecting CO_2 is still responsible for the lease site, it could be assumed that it would be responsible for meeting the costs of monitoring.

However should the proponent injecting CO_2 be responsible for conducting monitoring operations given the potential conflict of interest? It would not be in the interests of the injector to declare that there has been leakage particularly if there were financial penalties involved. Independent monitoring arrangements could address this issue.

Consideration could be given to:

- international standards for monitoring CO_2 movement underground; and
- international accreditation of monitoring organisations (particularly where national or international borders are near disposal sites).

Long Term Monitoring and Verification
When CO_2 injection ceases, who is responsible for ongoing monitoring? Should the organisation injecting CO_2 be responsible in perpetuity or for a specified period after injection ceases? In the latter case who would own the CO_2 and have the responsibility for monitoring in perpetuity after the specified period?

It is unclear where responsibility would lie if the injection occurred in international waters or where the injection site straddles national boundaries.

Long Term Maintenance Costs
Responsibility for maintenance costs associated with CO_2 storage needs to be determined to ensure CO_2 containment in the long term. Well casings in the storage region may need to be checked and recapped at regular intervals due to the corrosive nature of the CO_2 in solution. The liability may be considerable if there are a significant number of wells in the storage region.

Who would be responsible for these costs after the CO_2 injection ceases? What arrangements would be needed to address sites straddling national boundaries or under international waters?

Long Term Liability
Who would be held liable under market based mechanisms for greenhouse emissions released from storage sites which ceased operation decades earlier?

Would emissions from long term CO_2 storage sites be counted against a country's greenhouse emission targets under existing protocols and conventions?

Trans-Border Liability
If the CO_2 leaked from a geological structure in another nation but the original injection point was not within that nation's borders, how would liability for any leakage to the ocean or atmosphere be addressed?

This situation could occur where CO_2 migrates faster than expected or in a different direction than expected and proceeds under a border. It is possible that the original injection point was under international waters and the CO_2 moved inside nation's borders.

Liability for Loss of Resource

CO_2 may move underground into areas containing resources such as hydrocarbons or water resources preventing their utilisation. How would liability for loss of resources be addressed? Examples of scenarios include:

- the resources were known to exist but the CO_2 was not expected to move so quickly or in the direction of the resources;
- the resources were not previously known to exist and the CO_2 has moved beyond the anticipated containment area; and
- the resources were not originally economically viable and the CO_2 has moved beyond the anticipated containment area into the resource region.

A broad range of legal issues need to be considered by the CSLF countries inputting into an international perspective. Feedback from CSLF members about what they believe to be priority matters will be necessary to develop a work program. It is noted that many of these issues might be addressed by the IEA which is currently examining this subject in detail.

3.3 WORK TO DATE ON LEGAL ISSUES

The most significant recent work on legal issues appears to be the IEA Greenhouse Gas Research and Development Programme's *Review of International Conventions Having Implications for the Storage of CO_2 in the Ocean and Beneath the Seabed* (Report PH4/16). The report describes and analyses conventions and agreements which may have implications for CO_2 storage including seven global conventions, eleven EU directives and 16 regional conventions and agreements.

Overview of IEA Report PH4/16

Significant points from the report are outlined below:

Is the seabed included in conventions?

- Most regional conventions do not sufficiently define their area of jurisdiction to determine whether the seabed and sub seabed are included. This deficiency makes it difficult to determine the convention's relevance to geological disposal. The Vienna Convention on the Law of Treaties would need to be considered when determining whether the seabed is included.

Can CO_2 be dumped or stored in the seabed and in the ocean?

- One key convention constraining ocean or seabed storage is the London Convention 1972 which is global in scope.
- It applies to sea dumping from ships, aircraft and offshore installations and prohibits dumping except for specific categories of which the closest that fits CO_2 is inert, organic geological material (though CO_2 is neither inert nor geological).
- The definition of dumping appears to exclude wastes derived from the normal operation of offshore platforms which might include stripping CO_2 from offshore natural gas, if this is seen to be part of normal operations.
- The phrase dumping does not include the placement of matter for a purpose other than the mere disposal thereof, provided that such placement is not contrary to the aims of the Convention could imply that CO_2 storage in the seabed might be permitted. However it would be difficult to prove that the intent is to recover it at some stage in the future. It would be extremely difficult to argue that CO_2 placed in deep ocean water is being stored for future recovery. (Ocean sequestration won't be dealt with in this paper).

- The above phrase would appear not to prohibit enhanced oil recovery from CO_2 injection. However injection would not be allowed if the intent were to inject CO_2 for primarily storage/dumping purposes.
- If the 1996 Protocol to the London Convention comes into effect, there will no longer be a general ban on dumping of industrial waste (which may be more advantageous for CO_2 storage than under the London Convention 1972). The categories of material allowed to be dumped are basically unchanged.
- However the 1996 Protocol also defines dumping as any storage of wastes or other matter in the seabed and subsoil thereof from vessels, aircraft, platforms or other manmade structures at sea which is more restrictive on CO_2 sequestration than the London Convention 1972.
- "Storage" of CO_2 transported by pipeline from the mainland to the seabed or water is not prohibited by this or other conventions. However international agreements impede CO_2 discharge into the water.

IEA PH4/16 Recommendations

The report's recommendations suggest a strategy for proponents of CO_2 storage to gain acceptance for storage under international conventions. The strategy includes:

- gaining acceptance of storage among Contracting Parties to the London Convention 1972 and the 1996 Protocol to the Convention;
- demonstrating the net benefit to society of CO_2 storage;
- increasing participation at relevant convention forums and in particular those conventions which are more restrictive (eg the London and OSPAR6 Conventions); and
- determining the level of purity of CO_2 to be stored and what impact trace contaminants would have under various conventions.

Further IEA Work on Legal Issues

The Energy Technology Collaboration Division of the IEA is preparing an internal study on legal issues surrounding carbon capture and storage possibly as advance work for an international workshop. The study will focus on international treaties and frameworks but will also incorporate national legal and policy elements into the report. The information will improve the analysis in the study and possibly serve as the basis of a national CO_2 policy database which could help facilitate collaboration among countries which are considering how to incorporate CO_2 sequestration into existing legal frameworks.

3.4 RECOMMENDATIONS AND WAY FORWARD

To avoid duplication of effort, the CSLF Legal, Regulatory and Financial Issues Taskforce will liaise with the IEA Energy Technology Collaboration Division to discuss how the CSLF and the IEA might jointly progress the review of legal issues.

Any proposal for significant joint activities would be presented to CSLF members for consideration through the CSLF Secretariat.

CSLF members are requested to provide the Secretariat with details about legal issues which they believe should be addressed as a matter of priority.

[6] OSPAR entered into force in 1998 and covers the North East Atlantic.

4.0 FINANCIAL SECTION

4.1 INTRODUCTION

The economic attractiveness of carbon sequestration is dependent on both project costs of sequestration and costs associated with a country's policy and regulatory environment. Understanding how these two elements interact within an economy will be important for countries that wish to develop climate change policies that allow for CO_2 sequestration to be an eligible and realistic mitigation option.

While CO_2 sequestration is still in its infancy, a number of research programmes have been established and initial R&D investments have been made around the world by government and industry. In general, the literature that has emerged has shown that carbon capture and storage (CCS) technologies hold the potential to deliver significant, sustained and in the medium to longer term, cost effective emissions reductions. However, options on cost reduction and the development of a safe, effective and environmentally sound storage alternative need further analysis.

The purpose of this paper is to scope the existing work being undertaken on the financial aspects of CO_2 sequestration, and identify some relevant issues and areas for further work. It provides a basis on which to discuss financial and economic elements in more detail, and to develop a forward work-plan to progress these issues. Countries with expertise or an interest in this work are invited to take the lead in further work.

4.2 FINANCIAL AND ECONOMIC COSTS

Research on the financial and economic costs of CCS for industry and government is being performed in several countries and by several international organisations, as bench top studies at a project level and from a broader economy wide perspective. Various case studies and trials are being undertaken or considered to provide operating experiences. Much of this work has been assessed through international organisations such as the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA).

As our technical understanding has improved, interest in financial regulatory regimes has intensified because they have implications for the financial viability of CO_2 sequestration. In Norway, the carbon tax has been an important driver of the Sleipner project, where sequestration was chosen as the most cost-effective option to abate emissions. Key factors which are beginning to emerge as having an impact on costs include the deductibility of sequestration costs, effective life of investment assets, resource rent tax, corporate tax, GST and royalties. Defining who owns the CO_2 once sequestered is also an important issue creating an uncertainty that could hinder investment in sequestration technologies.

For large investment projects, proponents will be functioning in the risks and costs of meeting future greenhouse gas emissions constraints. Sequestration provides an opportunity to reduce the risks and costs, which will need to be compared against the additional costs of sequestration. A balance of regulatory constraints (eg greenhouse emission constraints on new projects) and economic mechanisms may further reduce the additional costs of sequestering CO_2.

Mechanisms that may be needed to facilitate the implementation of sequestration do not necessarily support the research and development that is needed to reduce the costs of CCS technologies.

The economic impacts of CCS technologies are likely to be from increased capital and operating costs and decreased efficiency of production, which reduce investment returns for significant periods of time. Policies which may be introduced to encourage sequestration such as implementation of subsidies and investment credits would reduce government revenue.

Sequestration projects also face a range of other project specific costs and economic drivers such as sequestration storage fees and the value of the CO_2 stream.

4.3 TECHNICAL COSTS

Currently, the reported costs associated with CCS technologies vary widely. The cost of sequestering CO_2 includes the cost of capture, as well as the cost of transmitting and storing it. Furthermore, many of the costs vary widely across countries, industries and projects, making them difficult to compare. In order to allow meaningful comparison of projects and useful information sharing, it is important to ensure that information reported on all cost components is transparent and that consistent methodologies and assumptions used are clearly stated. This is needed for considering technical aspects of CCS where they are to be compared and for comparing abatement costs from similar or alternative measures.

Considerable data is available on the costs of carbon geosequestration technology however, projected costs for CCS vary widely depending on the underlying assumptions made, particularly whether they are current or future costs. Studies have produced costs ranging from around $US10-60/tCO, and this wide variation can lead to potentially misleading data comparison. This has particularly been a problem when comparing costs for near zero emission power stations employing geosequestration.

In order to facilitate meaningful analysis and comparisons of cost projections, cost assumptions need to be made explicit. It may also be useful to agree on a standard set of inputs and assumptions.

The table at Attachment 4-A shows factors that could usefully be considered by industry and governments when assessing financial aspects of a CO_2 sequestration project. The table attempts to include all relevant cost factors relating to the capture and storage of CO_2.

4.4 ECONOMIC MODELLING

International research has led to an increased understanding of project specific CCS costs. However, the economic analysis of this mitigation option compared to other mitigation has been limited by the degree to which emerging technologies can be integrated into existing macro-economic models.

Many energy and economic models from around the world incorporate CCS technologies[7]. These include top-down and bottom-up models. Top-down models are macro in scope, and examine national economies and energy systems through a market framework driven by prices.

[7] Joint Global Change Research Institute, personal communication.

In contrast, bottom-up models use an engineering approach to build up detailed descriptions of technology and geography, and which focus on a particular aspect of the energy system or the energy system as a whole. Combining these approaches could strengthen our understanding of the potential for sequestration.

There has been considerable development on project level modelling of CCS technologies and the implications for industry. For example:

- The Joint Global Change Research Institute at Battelle is conducting quantitative analysis on the role of advanced technology option in providing affordable secure energy in a carbon-constrained world. The Battelle CO_2-GIS is a geographic information system based model for carbon capture and geological sequestration analysis, which contains data for North American sources and reservoirs.

- The Australian Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) has already undertaken a significant amount of project modelling on CO_2 storage. This will be followed up by further analysis by the three CRCs (Coal in Sustainable Development, Clean Power from Lignite and Greenhouse Gas Technologies) on capture costs starting in 2004, and it is envisaged that capture and storage elements will be integrated over the next 18 months. Following on from this, a fully integrated economic model will be developed for the sequestration process, feeding into the development of a macro economic model which takes into account the full costs and benefits of sequestration. Analysis of the extent of and economics of value added opportunities is also planned (see http://www.co2crc.com.au/resplan_f.htm).

Economic models are also being developed to show how CCS technologies might impact more broadly on the economy, and which allow comparison with other abatement measures. For example, in Australia:

- The Australian Bureau of Agricultural and Resource Economics (ABARE) is analysing the economic, environmental and greenhouse impacts of near zero emission technologies and the effectiveness of these technologies in contributing to national and international greenhouse response measures, through reassessing existing greenhouse and coal models in light of ongoing technological developments. This may involve revising energy productivity assumptions or underlying technical coefficients to better reflect technological developments in the modelling. ABARE will prepare a report for potential for consideration at the CSLF Ministerial meeting in September 2004, focussing on providing economic modelling expertise in areas of need and where there are identified gaps.

Understanding how top-down models will deploy CCS technology, including the varying treatment of capital stock and differing assumptions on the future availability and cost of various energy sources will be critical in driving results. Understandably, there are differing views on cost and performance data, and on the shape of the policy and regulatory environment (particularly in the future).

Detailed and accurate cost and availability data for geosequestration remains a crucial element in the modelling. Developing the capacity to model the impact of these factors on investment in CCS would provide government and industry with an enhanced understanding of how the policy and regulatory environment may impact on CCS deployment, and on how CCS technologies could impact on economic activity and abatement when compared to other options.

Attachment 4-B shows a broad range of these cost considerations related to CCS technologies.

In practice there may also be barriers or 'hurdle' rates which slow the adoption of sequestration technologies beyond that which is reflected in financial and economic modelling projections. For example, operators that have large investments in plant will not be able to respond to a low level carbon price signal (such as a small carbon tax) in the short-medium term. Alternatively, the assumption that a power plant operator will negotiate a share in the profits from enhanced oil recovery utilising its supply of CO_2 may be unrealistic. It is important to understand whether the assumptions which drive the modelling are realistic in practice, even though they may reflect optimal behaviour in theory. Broader collaboration with industry, government and researchers will assist in setting realistic assumptions.

4.5 RECOMMENDATIONS AND WAY FORWARD

This paper scopes some of the financial and economic issues relating to the deployment of sequestration technologies, however there are many more which are important and need to be considered. The group should discuss the range of financial elements relating to CCS, agree on how specific financial elements should be progressed, and develop a forward work-plan. The group should also continue to progress development of modelling on economic implications of CCS. Countries with expertise or an interest in this work may wish to nominate to lead work on these issues. Further, more detailed recommendations for the Taskforce on financial issues can be found in Attachment 4-C.

ATTACHMENT 4-A - CRITERIA REQUIRED TO ASSESS CO_2 INJECTION COSTS

CAPTURE OF CO_2

To develop an assessment of the costs of CO_2 capture typical information that would be required include:

- type of power plant technology i.e. PC, IGCC, CCGT
- pre or post combustion capture
- operating costs, including fuel, chemicals labour etc
- capital cost of plant
- ambient temperature, including water temperature
- percentage of CO_2 being captured
- CO_2 purity and export pressure
- plant size, availability and load factor
- project life and construction period

TRANSPORT OF CO_2

To calculate transmission costs, factors that would need to be considered include:

Pipelines:

- CO_2 throughput
- length of pipe
- type of terrain
- country regulations and laws
- pipeline inlet pressure
- number of pipeline compressors
- pipe diameter

Ships:

- capacity
- design temperature
- design pressure
- distance to travel
- speed
- loading/discharge time
- duration of round trip
- cost of tanker

STORAGE OF CO_2

Estimating the cost of engineering and equipment costs is dependent on numerous factors including:

- number and features of the wells
- CO_2 flow rate and period of injection
- type and amount of CO_2 impurities
- CO_2 temperature and pressure input to pipeline
- distance from source
- ground temperature
- relative elevation between source and sink
- water depth (if offshore)
- subsurface depth of the storage reservoir
- reservoir temperature and pressure
- reservoir net thickness
- reservoir permeability
- reservoir radius

ATTACHMENT 4-B - COSTS ASSOCIATED WITH CCS

PROJECT COSTS	EXTERNAL COSTS
Operating: - fuel - consumables & chemicals - labour - maintenance - insurance	General Policy: - energy/carbon taxation - environmental compliance - health and safety compliance
Capital: - power station and/or associated capture equipment - pipeline/ ships - compressors - storage plant & equipment - well drilling	Financial Regulation: - GST - general taxation - resource rent tax - asset depreciation - liability - royalties - sequestration storage fee - performance bonds
R&D improvements	Other: - public perception
Production efficiency loss	

ATTACHMENT 4-C – FINANCIAL RECOMMENDATIONS

RECOMMENDATION 1
Explore the balance of greenhouse insurance measures, regulations and financial mechanisms that impact on the attractiveness of sequestration, possibly through existing forums such as the IEA's GHG Programme.
RECOMMENDATION 2
Encourage examination of the extent of opportunities for 'value-added' reservoirs' (that is, where sequestration technologies may have lower or even negative cost if captured CO_2 can be used to produce hydrocarbons and therefore offset the costs of sequestration).
RECOMMENDATION 3
That a standard set of cost inputs and data on timing issues be agreed upon. The CSLF may wish to consider the document at Attachment 4-A as a basis for further development of such an approach.
RECOMMENDATION 4
- *Support further work on the integration of top-down and bottom-up models where it relates to CCS technologies.* - *Ensure appropriate sensitivity analysis is conducted on key drivers in the modelling and the impact these have on deployment of geosequestration technologies.* - *Support further development of consistent and comprehensive modelling data and engage in discussions to agree on a consistent and where possible collaborative approach for future analysis.*