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Legal and Regulatory Developments Associated with Carbon Dioxide Capture and Storage: A Global Update

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Abstract

Carbon dioxide capture and storage (CCS) is widely seen as a critical technology to de-carbonise the power and industrial sectors. As such, many nations have ambitious plans to demonstrate and then promote commercial scale development of CCS. To facilitate early demonstrations and lay the groundwork for widespread use of CCS, governments are rapidly developing new CCS regulations and policies. There have been a number of important regulatory and legal developments in the European Union, United States, Australia, Canada, Norway and several other jurisdictions. This paper and presentation will provide a brief but comprehensive update of these developments and will document and synthesise discussions and activities that were undertaken as part of the IEA's International CCS Regulators' Network. It is hoped that information sharing of this kind can help to facilitate harmonised global approaches to regulating CCS.

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1. Introduction

1.1 *International CCS Regulators' Network*

To foster the demonstration and commercial use of CCS, governments have begun developing CCS regulations and policies in a number of countries and in international conventions. To help inform the development of legal and regulatory frameworks for CCS, in 2004, the International Energy Agency (IEA) launched a project to inform and engage regulators and other experts on various legal aspects of CCS. This was followed, in 2008, by the launch of the International CCS Regulators' Network,¹ which aims to provide a forum for potential CCS regulators and afford them the opportunity to discuss possible solutions to challenges they face in developing adequate CCS legal and regulatory frameworks.

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The Carbon Capture Legal Programme (CCLP),² based in the Faculty of Laws at University College London, was established to provide an authoritative source of objective, up-to-date and comprehensive information on CCS; with a view to promoting informed discussion and analysis by decision-makers in government, industry and the wider community. The CCLP acted as a co-host for the launch of the International CCS Regulators' Network in Paris and continues to work with the IEA to further its work in this field.

The IEA Greenhouse Gas R&D Programme (IEA GHG) also works to assist the development of regulation for CCS, particularly by providing the evidence upon which regulation development can be based. Many of the reports and Network activities of the IEA GHG feed directly into the regulatory development processes including, for example, the capture-ready concept in proposed EU regulation, and evidence on CO₂ stream impurities assisting the London and OSPAR conventions. IEA GHG worked with IEA and CCLP in the creation of the International CCS Regulators' Network.

1.2 Regulatory Developments

Over the past twelve months, significant efforts have been made by national and regional legislators to develop dedicated CCS legislation. For example, there have been recent legislative proposals from the European Union, United States and Australian legislators for the regulation of CCS activities; as well as parallel discussions regarding further critical legal issues for CCS.

The past year has also seen the amendment of international and regional legislation, which has removed many of the obstacles that have barred the development and support of this technology.

This paper, which is based upon research undertaken at the IEA in the preparation of its new publication *CO₂ Capture and Storage: A Key Carbon Abatement Option*,³ the CCLP, the first meeting of the International Regulators' Network and its subsequent web-conferences, will serve as a year-end summary and a guide to future CCS legal developments.

2. Dedicated CCS Legislation

In January 2007 the European Commission launched the world's first example of dedicated CCS legislation, its proposal for a Directive setting out a framework regulatory regime for the geological storage of carbon dioxide. Similar legislative systems have been designed in the United States and Australia, and are currently being refined and developed as they progress towards ratification by national legislatures and administrations.

These proposed instruments are fundamental, not only for the advancement of CCS as a technology, but also as potentially transferable models for European Member States and other countries around the world.

2.1 Proposed European Directive on the Geological Storage of Carbon Dioxide

The draft Directive released in January seeks to ensure that CCS is a viable climate change mitigation option and was part of a wider package aimed at ensuring energy security and a reduction in emissions for European Member States.

The proposal sets out a regulatory regime for the permitting of exploration and storage, and establishes criteria for the selection of storage sites. Under the Directive, the Commission would have a role in reviewing and providing comments on any draft storage permits, however, the nature of this role is yet to be determined. Although this opinion is not binding upon Member States, they are required to provide reasons if they decide against the Commission's suggestions.

Operational, closure and post-closure obligations are imposed under the proposed Directive, including monitoring and reporting requirements and the immediate remediation of any irregularities or leakages. Operators

are also required to make financial provision to ensure that all the terms of the Directive and the issued permit are adhered to. The proposed Directive provides for the transfer of responsibility in the long-term from the operator to the competent authority when all evidence indicates that the stored CO₂ will be completely contained for the indefinite future. The timescales and wording for this transfer have yet to be determined.

An important aspect of the proposal is that it focuses mainly upon the geological storage of carbon dioxide and makes amendments to existing legal instruments to regulate the capture and transport aspects of the technology. As part of these important amendments to existing EC legislation, specific CCS activities are excluded from the effect of potentially obstructive provisions. The Water Framework Directive; Waste Framework Directive and the Regulation on the Supervision and Control of Shipments of Waste, are all amended to facilitate the progress of CCS technologies.

Similarly, various amendments have been made to explicitly include CCS activities within the scope of existing regulatory provisions. Carbon dioxide capture, transportation (by pipeline) and storage are explicitly included within Annex I of the Environmental Impact Assessment Directive, whilst the capture aspect of the process is included within Annex I of the Integrated Pollution and Control Directive. The proposal specifies amendments to Annex III of the Environmental Liability Directive, to ensure liability for local environmental damage is applied to the operation of CO₂ storage sites.

The proposal is to be adopted under the co-decision procedure and requires the approval of both the Council of the European Union and the European Parliament to become law. The European Parliament's official CCS Rapporteur, Chris Davies MEP, has filed his final report to MEPs and adoption of the proposal is expected by the end of 2008 or early 2009.

2.2 United States

The US Environmental Protection Agency's (EPA) Proposed Federal Rule for CO₂ Geological Sequestration Wells Under the Underground Injection Control (UIC) applies to owners or operators of wells which inject CO₂ into the subsurface for the purpose of long-term storage. The proposal is based on the existing Underground Injection Control (UIC) regulatory framework, which provides for the protection of underground sources of drinking water. In order to address the unique nature of CO₂ injection for geological sequestration, a new category of injection well for compressed CO₂ has been created, covering the entire process of CO₂ storage from site characterisation to post-injection site care and closure. The rule does not regulate areas of capture and transport, nor does it apply to CO₂ injection for the purposes of Enhanced Oil Recovery (EOR). Whilst a default timescale of 50 years for post-injection site care (monitoring) has been tentatively suggested by the EPA, there is no provision for the development of measures to transfer liability from one entity to another. The rule will not be enacted until late 2010.

The 'Boucher Bill' H.R. 6258 (to be the *Carbon Capture and Storage Early Deployment Act* if enacted), was introduced into the House of Representatives in 2008 and aims to accelerate development and early deployment of CCS technology. The Bill provides a mechanism for the establishment of a Corporation charged with the purpose of distributing, in a diverse fashion, industry-levied funds to CCS activities, including in particular commercial-scale CCS demonstration projects. The establishment of the Corporation is dependant upon the outcome of a referendum of qualifying industry organisations, namely, fossil fuel-based electricity utilities, with approval coming from two-thirds of the referendum in favour of establishing the Corporation. Voting rights are to be allocated in accordance with proportions of electricity delivered to consumers, and the referendum is to be conducted by an independent auditing firm at the expense of the qualifying industry organisations. The Corporation is to operate as a division of the Electric Power Research Institute, but will not be considered a public agency in any respect. Its Board will consist of representatives from a range of utilities, and will have the power to collect 'assessments', funds extracted from utilities, the amount of which reflects relative carbon dioxide emissions rates. The total revenue is to be between \$1.0 - \$1.1 billion, and failure to comply with an assessment levied will be enforceable in the Courts.

The Bill essentially facilitates diverse, but *coordinated*, industry-lead investment in CCS.

In March 2008, Wyoming became the first US State to pass specific legislation for the long-term storage of CO₂. House Bill 0090 (Enrolled Act No. 25 of 2008 budget session) gives the Wyoming Department of Environmental Quality responsibility for the issuing of permits for long-term storage of carbon dioxide, creating a regime separate from CO₂ injection for the purposes of EOR. The legislation provides a framework, with the detail of permitting requirements to be defined by the Department. The regime will operate within the existing USEPA UIC drinking water framework (above). Applications for permits must include, amongst other things, proof of financial assurance, detailed site characterisation, monitoring plans and schedules for post-closure monitoring and verification. In addition, a working group is to be convened for the purposes of developing an appropriate bonding procedure and other financial assistance methods. Such operations will be required throughout the operational phase and into the post-closure care period, the duration of which is also to be defined with reference to recommendations made by the working group. The ‘minimum’ outline in the Act is that assurance for closure and reclamation costs, post-closure inspection and maintenance costs and environmental monitoring, verification and control costs be covered.

2.3 Australia

The Offshore Petroleum Amendment (Greenhouse Gas Storage) Act 2008 is a detailed piece of federal legislation, which aims to provide certainty for operators regarding access and title to offshore greenhouse gas storage formations, while also ensuring that storage is safe and secure. A primary concern of the Act is to demarcate the interaction between petroleum title holders and incoming greenhouse gas title holders through an ‘impacts test’, designed to protect the former from the latter. The range of permitting options formulated broadly corresponds to existing licences concerning petroleum activities. Current provisions relating to pipeline licenses will be expanded to provide for greenhouse gas pipelines, and a greenhouse gas Lease would afford flexibility while a commercial source of greenhouse gas for injection is sourced.

Actual greenhouse gas injection will be regulated through an Injection Licence, requiring a comprehensive site plan. At the end of the life of the site, decommissioning reports must be submitted to the appropriate Minister, together with suggestions for monitoring, measurement and verification. The holder of an Injection Licence will not be free of statutory liability until a ‘site closing certificate’ has been issued, a requirement of which includes a thorough assessment of migratory behaviour of the injected greenhouse gas. As a result of last minute amendments in the Senate, the Act now also provides for the transfer of long-term liability from the operator to the government at the end of a ‘closure assurance period’ constituting a minimum of fifteen years. In addition, subject to an operator having met all closure obligations and the Minister forming a favourable view as to any remaining risks, there is a potential twenty-year ‘sunset’ period on a proponent’s liability in damages for activities carried out under a CCS licence.

The definition of ‘greenhouse gas substance’ will initially cover CO₂, together with any substances ‘incidentally derived’ from the capture, transport or injection processes. The possibility of expanding the scope of operation to other greenhouse gases is incorporated into the Act, but this power is not expected to be exercised until the 1996 Protocol to the London Convention against dumping at sea (discussed below) is amended to permit geological storage of those other greenhouse gases.

The Greenhouse Gas Geological Sequestration Act 2008 was introduced to the Victoria Legislative Assembly on 9 September 2008, receiving Royal Assent on 5 November 2008, and, in a similar fashion to the EC Framework Directive, is concerned with the storage element of CCS. The Act provides a detailed permitting regime concerning sequestration of ‘greenhouse gas substances’, those made up ‘overwhelmingly of either or both carbon dioxide and/or a prescribed greenhouse gas’. Carbon dioxide is the only named greenhouse gas substance in the Act, although others may be prescribed.

The Act, modelled on the tenure system for petroleum operations, creates three types of permit: (i) an ‘injection permit’, (ii) an ‘injection and monitoring licence’ and (iii) a ‘greenhouse gas sequestration formation retention lease’. If the holder of the first discovers storage space, he has the right to apply for one of the others. The formation retention lease grants a potential operator fifteen years leeway to exploit an underground storage space where the activity is ‘not yet commercially viable’. Detailed requirements are set out for various plans, which will be referred

for recommendations to other key governmental departments or agencies. The Minister may only approve plans where there are no risks to public health and/or the environment. The Act establishes Crown ownership of all sub-surface geological storage formations in Victoria, and on surrender or cancellation of a licence the Crown will thereby become owner of injected greenhouse gases.

The Act also introduces provisions to manage public health and environmental risks and long-term liabilities, as well as proscribing monitoring and verification requirements. Community consultation and local government involvement in decision-making will also be a requirement for any permitting applications. Additionally, and in a similar fashion to its Commonwealth counterpart (above), the Act attempts to regulate potential conflicts between greenhouse gas sequestration and other uses of resources, by applying public interest criteria.

3. Priority Legal Issues for Future CCS Development

In addition to the aforementioned emerging regulatory regimes, an increasing number of auxiliary legal and regulatory issues will also require consideration. These issues are tangential to the development of regulatory frameworks and cover a broad range of topics; however, their impact may vary depending upon the processes and jurisdictions involved.

Research undertaken by the IEA and the CCLP has recognised the significance of many of these issues and that their resolution is critical for the deployment of CCS technologies. The recent meetings and web conferences of the International CCS Regulators' Network have focused upon many of these issues and discussed relevant national and international experiences, some of which are discussed in the following subsections.

3.1 CO₂ Transport and Safety

The transport of carbon dioxide from capture installations to the final storage site via pipeline is one issue which has begun to be addressed. The need to ensure the protection of the environment and public health, as well as to secure the status of CCS as a viable climate change mitigation option, requires effective legislation in this field.

Fortunately, there is significant international experience of transporting natural gas by pipeline and many instances already exist where CO₂ is transported for the purpose EOR, for example, in the US and Canada. However, some parties have expressed concern regarding many unknown and uncertain aspects associated with transport of this nature. In the United Kingdom, for example, the Health and Safety Executive (HSE) recently published its initial view on the safety of transporting CO₂ by pipeline for CCS activities. The interim guidance concludes that the hazards of transporting natural gas 'are very different' from gas, and makes various recommendations with regard to CO₂ transportation in the United Kingdom; including the need for initiatives and projects to develop best practice guidelines for the transmission of CO₂ in onshore and submarine pipelines.

The siting of pipelines and the granting of continued access is also an area of regulatory concern. Research from the IEA and the recent web-seminar highlighted the need for current regulatory frameworks to be adapted to accommodate the anticipated increase in the volumes of CO₂ to be transported for the purpose of geological storage. Legislation governing planning permissions, environmental impact assessment, rights of way and the compulsory acquisition of land may all need to be evaluated in light of this increased expansion of pipeline networks.

3.2 Jurisdictional Issues

The inter-play and relationship between international, supranational, national and sub-national authorities will also need to be clarified in order to ensure efficient development of CCS technologies. In some countries, such as Australia, the United States and Canada; state or provincial governments will assume significant responsibility for CCS project regulation. Furthermore, the incorporation of CCS into some international agreements (see discussion below) will mean that even supra-national organisations (such as the European Union) and international bodies like the London Convention will be charged with verifying the effectiveness of CCS regulation. To date, countries have

not begun to address the issue in a systematic way; it will undeniably be an important early issue for national authorities as the first demonstration projects are considered.

3.3 Site Selection, Monitoring and Verification

Various studies have suggested that the management of the potential risks associated with CCS, including seepage into groundwater supplies or the atmosphere and the endangerment of human health or specific environments, may be achieved through the expeditious use of monitoring and reporting guidelines. The regulation of these issues will be critical if CCS is to be viewed as a reliable and safe climate change mitigation option.

The selection of suitable storage sites, those that will provide long-term CO₂ retention, are critical for demonstrating the viability of CCS. There is, therefore, a need for detailed site selection guidelines, which may be applied across a range of potential sites. Once stored, continued monitoring of the CO₂ shall be essential to ensure that there is no leakage or damage caused to the surrounding environment, which would require immediate remediation. Monitoring methodologies may also be potentially significant in instances where credit could be awarded to operators under the various climate change agreements.

The Intergovernmental Panel on Climate Change's (IPCC) 2006 Guidelines provide a starting point for inventory methodology guidelines for the treatment of CCS. These Guidelines provide a methodology for CCS, '*including fugitive losses from CO₂ capture and transport stages (which are estimated using conventional inventory approaches) plus any losses from carbon dioxide stored underground (estimated by a combination of modelling and measurement techniques, given the amounts injected - which would also be monitored for management purposes)*'. The London Protocol has also established risk assessment guidance for CO₂ storage permitting. Given the global interest in CCS, it is clear that monitoring and verification standards will benefit from greater international efforts toward harmonisation.

3.4 Liability and financial security

The liability issues posed by the long-term storage aspect of CCS are not particular to this technology; however a strong regulatory framework is required to ensure clarity. Many liability and financial security regimes already exist for nuclear waste, natural gas storage and hazardous waste; upon which a competent system for CCS may be modelled. There has been much discussion as to which instruments should be utilised, but research suggests particular instruments will be better suited to the injection, closure and post-closure periods. Of particular concern is the phase beyond decommissioning and transfer post-closure.

The role of operator and government must be clearly distinguished within the regulatory framework, in instances where the site is to be decommissioned and transferred post-closure. The proposed EU Directive in its initial form, for example, allows for the transfer of the storage site to a Member State's competent authority, once '*all available evidence indicates that the stored CO₂ will be completely contained for the indefinite future*'; it is important therefore that subsequent legislation clarifies the exact nature of the term, criteria and evidence required to allow the utilisation of this flexible condition. For liability, the general view is that more work and analysis is required in this field. In particular, private sector insurance and financial companies should be engaged to offer ideas and models for CO₂ storage liability coverage. The IEA is beginning to draft a paper on this topic.

4. Consideration of CCS in International and Regional Law

Aside from the recent examples of dedicated regulatory frameworks, international policymakers have increasingly seen CCS as an appealing climate mitigation option, which has resulted in the amendment of various international and regional laws. In many instances the legislation concerned was not drafted with CCS in mind, or was a part of numerous overlapping legal regimes and required clarification from the international signatories and parties.

In instances where existing legal frameworks have been perceived as ambiguous, or directly obstructive to the deployment of CCS technologies, the international community has been active to modify or amend the conventions and treaties concerned. These amendments demonstrate the strong political will and the speed at which change can be affected in international and regional legislation, as well as the opportunity for existing legislation to inform future regulation. Nowhere is this more evident than in the following international agreements.

4.1 The London Protocol and OSPAR Convention

The London Protocol and OSPAR Convention are both concerned with the protection of the marine environment. The former is an international agreement that seeks to ‘eliminate pollution caused by dumping or incineration at sea of wastes or other matter’; whilst the latter is a regional agreement aimed at protecting the waters of the North-East Atlantic and North Sea.

The London Protocol contained restrictive measures relating to the permitted dumping of waste in the marine environment, save for particular materials listed in its Annex. CO₂ was not listed in this Annex and as a consequence created uncertainty as to whether the Protocol prohibited certain CCS activities. In November 2006 a resolution to amend the Protocol was adopted and subsequently, in February 2007, it entered into force for the Contracting Parties. The amendment inserted a new category into the Protocol’s Annex, allowing permits to be granted for ‘carbon dioxide streams from carbon dioxide capture processes for sequestration’, thus removing the uncertainty and introducing the obligation for regulation. A further amendment provided criteria for the CO₂ streams with regard to their purity and a set of Guidelines detailed the steps to be taken before the issue of a permit.

These amendments provided, for the first time in international law, the regulation of CO₂ storage in sub-seabed geological formations.

The OSPAR Convention regulates polluting activities in the sub-seabed and subsoil and also contains certain restrictive provisions regarding pollution from land-based sources. Many of these provisions may have meant that certain CCS activities would have fallen foul of the Convention. In June 2007, the parties to OSPAR decided to adopt amendments to the Convention to allow for CO₂ storage in sub-seabed geological formations (subject to certain conditions).

New paragraphs were inserted into the Convention’s Annexes allowing for the permitting of sub-seabed sequestration of CO₂ streams for storage; provided the streams consisted ‘overwhelmingly’ of CO₂ and no other wastes or materials were added for disposal. A further Decision required that specific CO₂ guidelines are to be used when issuing permits for CCS activities and a Framework for Risk Assessment and Management of CO₂ Streams in Geological Formations (FRAM) provides Parties to the Convention with an ‘iterative process’ to ensure the continual improvement of a project throughout its lifetime.

4.2 International climate change legislation

The United Nations Framework Convention on Climate Change contains no explicit reference to the use of CCS, although the Kyoto Protocol does require Annex I parties to undertake ‘research on, and promotion, development and increased use of...’, *inter alia*, carbon dioxide sequestration technologies. Proposed new accounting and inventory methodologies (by IPCC and others) have gone some way toward the inclusion of CCS in the portfolio of climate change mitigation mechanisms. The discussion of developments in these areas of international law are particularly significant because their mechanisms have been identified as potentially making CCS activities financially viable.

As part of Kyoto’s ‘flexible mechanisms’, parties to the Protocol may decide how they will best meet their reductions during the commitment period and effectively lower the cost of compliance with the targets they are issued. One of these mechanisms, the Clean Development Mechanism (CDM), allows developed nations to sponsor or pay for emission reduction projects in less affluent countries; in return for credits that they may put towards their own emissions targets. It has been suggested that CCS projects should be included within the CDM and therefore enable operators to generate credits in a cost-effective manner.

The CDM Executive Board, the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Conference and Meeting of the Parties (COP/MOP) to the Protocol, have all considered whether CCS is to be included in the CDM. Many concerns have been raised by the Parties; some have focused upon the ‘project boundary’ of CCS projects, in particular where storage spans international boundaries, or where there is multiple use of the same reservoir. Other concerns have been accounting for leakage or the additional energy penalty associated with capturing CO₂. It is hoped that a final decision as to its inclusion will be made at the fourth COP/MOP in December 2008.

5. Conclusion

This short note attempts to summarise key CCS legal developments; it is not a comprehensive review. From this summary, however, it is clear that there is rapidly growing capacities at all government levels to develop regulations for CCS. This is evidenced in the emergence of dedicated legal frameworks and the speed of the various amendments to international agreements. Although much has already been achieved, most recent developments are primarily of a framework nature, which create permitting mechanisms and leave much to the competent authorities to achieve. In addition, the emergence of other legal issues is significant. Issues such as long-term liability will need to be addressed in parallel to the emerging framework legislation. Of particular note are the efforts made by early frameworks to regulate some aspects of CCS, particularly CO₂ capture and transport, under existing oil and gas (or related) frameworks. These existing legal regimes offer important models that may be adaptable to facilitate the effective regulation of CCS. It will be important to ensure that once implemented, CCS frameworks are applied consistently and the potential for ‘forum shopping’ is avoided. In addition, as many jurisdictions are attempting to develop similar frameworks at the same time, efforts like the CCS Regulators’ Network and the CCLP aim to increase harmonisation and efficiencies via the free exchange of information.

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