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Legislation and Policy

THE NEW DIRECTIVE ON THE GEOLOGICAL STORAGE OF CARBON DIOXIDE

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INTRODUCTION

Carbon capture and storage (CCS) is a controversial response to climate change, described variously as a 'magic bullet';[1] 'an uncomfortable but necessary option';[2] 'an expensive distraction';[3] and a 'false hope'.[4] The Directive on the geological storage of carbon dioxide (CO_2)[5] provides a legal framework for the regulation of CCS. CCS is the process of removing CO_2 from the emissions of industrial processes, injecting and storing it permanently underground, where it is prevented from entering into the atmosphere and thus contributing to climate change. While the climate change imperative seems to have provided significant impetus for expedited negotiation and adoption of the Directive,[6] CCS technology is of course as much about energy security and the continued use of fossil

1 See 'The "magic bullet" of energy supply', *The Times*, 9 September 2008.

2 Dr Stephan Singer, 'CCS – an uncomfortable but necessary option', Presentation on behalf of WWF International (30 January 2008, Brussels), available at <http://ec.europa.eu/environment/climat/ccs/pdf/ccs_option.pdf>.

3 John Vidal, 'Is carbon capture really the panacea that will both secure our energy supply and save the planet – or an expensive distraction?', in 'Going Underground – Is carbon capture the answer to the energy dilemma?', *The House Magazine (Carbon Capture Supplement)* (17 November 2008, DODS). For a review of the costs involved in CCS, see McKinsey & Company, *Carbon Capture & Storage: Assessing the Economics* (McKinsey, January 2009).

4 E. Rochon *et al.*, *False Hope – Why carbon capture and storage won't save the climate* (Greenpeace International, 5 May 2008), available at <http://www.greenpeace.org/raw/content/international/press/reports/false-hope.pdf>.

5 Directive 2009/31/EC on the Geological Storage of Carbon Dioxide [2009] OJ L140/114, hereinafter the 'Directive' or 'CCS Directive'. The Directive entered into force on 25 June 2009 with a transposition deadline of 25 June 2011 (Article 39). In the UK, a draft regulation proposing an offshore carbon dioxide storage licensing regime was released for consultation, closing on 30 December 2009. The draft Storage of Carbon Dioxide (Licensing) Regulations, developed pursuant tot he Energy Act 2008, will form part of the UK's transposition of the CCS Directive. See <http://www.decc.gov.uk/en/content/cms/consultations/co2_storage/co2_storage.aspx>.

6 The Directive was released in 2008 and definitively adopted within 15 months.

fuels.[7] In response to policy options which would favour enhanced investment in renewables and energyefficie ncy over the continued use of coal, the Directive notably describes CCS as 'a bridging technology' which 'should not serve as an incentive to increase the share of fossil fuel power plants'.[8]

The Directive does not make CCS mandatory for new or existing fossil fuel power stations, which in view of the technology's infancy was thought premature.[9] Efforts have been made, however, to incentivise and provide investment in CCS via the EU Emissions Trading Scheme (ETS), which from 2013 will not require the surrender of allowances in respect of CO_2 verified as captured and transported for permanent storage to a facility with a storage permit.[10] There is to be no free allocation of allowances to CCS operators,[11] though allowances from the New Entrants Reserve will be made available to support CCS demonstration plants.[12] Additionally, Member States will be permitted to use funds from auction revenues to support CCS projects.[13]

The CCS Directive applies only to the storage of CO_2 in geological formations[14] within the territory of Member States, their exclusive economic zones and on their continental shelves.[15] This envisages CO_2 storage both on and offshore. The underpinning aim of the Directive is the 'environmentally safe' storage of CO_2, meaning the permanent containment of CO_2 'in such a way as to prevent and, where this is not possible, eliminate as far as possible negative effects and any risk to the environment and human health'.[16] Such risks stem from the fact that CO_2 is corrosive and an asphyxiant which is also denser than oxygen, potentially fatal for humans, animals, biodiversity and marine life. Atmospheric release can be damaging to the surrounding environment and leakage into water can cause acidification and contamination.[17]

The Directive focuses on addressing the storage of CO_2, opting to regulate capture and transport within existing regimes. Uncertainty as to the legality of CCS posed by existing EC legislation concerning water and waste is clarified.[18] This note will provide a brief overview of the Directive and outline some of the key difficulties in the approach it adopts, starting with capture and transport before turning to storage.

7 See the Impact Assessment to the Directive, SEC (2008), 13-7, in particular on 'the need for an economic and sustainable electricity supply for Europe'.
8 Recital 4 of the Preamble.
9 Impact Assessment generally.
10 Article 1(15)(b) of Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance-trading scheme of the Community [2009] OJ L140/63, hereinafter the 'ETS Directive'.
11 ETS Directive, Article 1(11)(1).
12 ETS Directive, Article 1(12)(8). The New Entrants Reserve is a fund set aside for new installations and extensions to existing permitted installations.
13 ETS Directive, Article 1(11)3(e).
14 Defined in Art. 3(4) as a lithostratigraphical subdivision within which distinct rock layers can be found and mapped.
15 Article 2(1), continental shelves within the meaning of the United Nations Convention on the Law of the Sea (UNCLOS) and Art. 2(3).
16 Article 1(1) and (2).
17 See further Impact Assessment, Annex II.
18 See Arts 32, 35 and 36 amending the Water Framework Directive 2000/60/EC, Directive 2006/12/EC on waste and Regulation (EC) No. 1013/2006 on shipments of waste, respectively. See also Explanatory Memorandum to the Draft Directive, COM(2007) 844, 7. The University College London Carbon Capture Legal Programme provides detailed analysis of the applicability of water and waste legislation to CCS: <http://www.ucl.ac.uk/cclp.>

CAPTURE[19]

Capture will primarily be regulated through incorporation within the Integrated Pollution Prevention and Control (IPPC) regime.[20] As such, all operators of capture installations will be required to obtain a permit for CO_2 capture, making such technologies subject *inter alia* to the IPPC's rights to public participation and the requirement to use best available techniques.[21] Article 31 of the CCS Directive will also require an assessment of CO_2 capture facilities within the general provisions of the Environmental Impact Assessment (EIA) Directive.[22] Again, public consultation will be required and the assessment carried out must be taken into account when permitting the facility.[23]

Carbon Capture Readiness and Emissions Performance Standards

The Directive does not require all new combustion plants to be constructed 'Carbon Capture Ready' (CCR).[24] Instead, it requires the operator to set aside suitable space for a capture facility only if the competent authority considers that there are suitable storage sites available and that transport facilities and the retrofit of capture technology are technically and economically feasible. The requirement is not exacting. There are no potential timescales for the retrofit for CCS, and there is no mechanism for requiring an actual retrofit later.

By 2015, the Commission is to carry out an assessment of the CCR requirement.[25] This will no doubt consider in tandem the potential imposition of a CO_2 Emissions Performance Standard (EPS) or CO_2 limit value.[26] EPSs are posited by some as a more robust alternative to CCR, requiring CCS from the outset while also promoting other cleaner power generation, including renewable energy and efficient gas.[27]

Following consultation, the UK government has opted to go beyond the requirements of the Directive, and from 9 November 2009 will require any new coal power station to demonstrate the full CCS chain (capture, transport and storage) at commercial scale. Under the consent procedure for new coal-fired power stations, evidence will have to be produced that the plant will be capable of demonstrating CCS from the outset on a portion of the power station.[28] In addition, the remainder of such power stations would need to be CCR – namely, that the consenting authority considers it will be technically and

19 'Capturing' involves different processes. For a description of various capture technologies, see, for example, International Energy Agency (IEA), *CO_2 Capture and Storage* (IEA/OECD, 2008).
20 Art 37 amending the IPPC Directive 2008/1/EC (codified version).
21 IPPC Directive Arts 15 and 9, respectively.
22 Directive 85/337/EEC. A distinction is drawn on the basis of capture volumes between those installations which will fall within Annex I and Annex II of the EIA Directive, with respective consequences for whether an assessment is mandatory or to be determined on a case by case basis. Article 31(1)(b) and (2)(a) CCS Directive and Art. 4(1), 2(3) and 4(2) EIA Directive.
23 Impact Assessment, 34 [115].
24 Article 33 amending the Large Combustion Plants Directive 2001/80/EC applying to plants with a rated electrical output of 300 MW or more.
25 Article 38.
26 Article 38(3) requires the Commission in 2015 to consider imposing an EPS if CCS has been sufficiently demonstrated.
27 See C. Littlecott (ed.), *A Last Chance for Coal – Making Carbon Capture and Storage a Reality* (Green Alliance: 2008) 29–39, and Environmental Audit Committee, Ninth Report of Session 2007–08, *Carbon Capture and Storage* HC 654.
28 Proposed power stations will have to demonstrate capability of demonstrating CCS on at least 300MW net of its capacity. Coal power stations of less than 300MW net capacity will have to show that carbon dioxide will be captured from their full capacity. See Department of Energy and Climate Change (DECC), *A framework for the development of clean coal – Consultation Response* (November 2009) and DECC, *Consultation on draft supplementary guidance for Section 36 Applications: New Coal Power Stations* (November 2009).

economically feasible to retrofit CCS to that power station in the future and that suitable transportation and storage options exist.[29] It is expected that plants receiving consent under these policies will retrofit CCS to full capacity by 2025, following a report planned for release in 2018 which will consider any necessary additional measures to drive CCS development.

TRANSPORT

As the cheapest option for most Member States, transport of CO_2 from capture facilities to storage sites is most likely to be through pipeline networks.[30] There is considerable experience of CO_2 pipeline transportation in the US though little similar experience in the EU.[31] The Directive addresses the transport aspect of CCS in few provisions, relying principally on national property and planning laws together with existing European legislation.[32] Transportation of CO_2 via pipeline will be subject to an EIA,[33] which will need to be taken into account in the consenting procedures within the Member States.

The Directive deals with third-party access to both transport networks and storage sites, both of which will be addressed here. Operators will only be permitted to refuse access to transport networks and storage sites on the grounds of lack of capacity.[34] An operator may be compelled, however, to make any necessary enhancements as far as it is economic to do so, or if the potential customer is willing to pay for such changes.

STORAGE

The basic structure of regulated CO_2 storage activity under the Directive involves: a period of site selection, perhaps involving invasive exploration of formations; application for and granting of a storage permit; the operational phase of the storage activity, accompanied by a regime of monitoring, reporting and inspection; closure of the site, after which the operator remains responsible for the site for a period until such responsibility is transferred to the competent authority in the Member State.

Site selection and exploration

The Directive draws a distinction between the 'storage site', a defined volume area within a geological formation used for CO_2 storage and its associated injection facilities,[35] and the larger 'storage complex', which refers to the storage site itself and the surrounding region affecting containment.[36] A formation can only be selected for storage if there is 'no

29 DECC, *Carbon Capture Readiness (CCR): a guidance note for Section 36 Electricity Act 1989 consent applications* (November 2009). See also the most recent consultation, DECC, *Draft Supplementary Guidance for Section 36 Electricity Act 1989 Consent Applicants for Coal Power Stations: A Consultation* (November 2009). The requirement for CCR operates as policy operating under the Electricity Act 1989 s. 36 consent procedure and applies to new combustion power stations in England and Wales with a generating capacity of over 300MW and of a type covered by the Large Combustion Plants Directive. Applications for development consents in respect of new power stations will eventually come within the responsibility for the new Infrastructure Planning Commission, pursuant to the Planning Act 2008.

30 Client Earth, *Laying the Regulatory Foundations for Carbon Capture and Storage in the EU: A Legal Review of the Draft European Directive on Geological Storage of Carbon Dioxide* (October 2008) 29.

31 Ibid., 27.

32 Ibid.

33 Pipelines with a diameter of more than 800mm and length of more than 40km are included within Annex I of the EIA Directive, with all other pipelines falling within Annex II. Article 31(1)(a) and (2)(b), CCS Directive.

34 Article 21(3).

35 Article 3(3).

36 Article 3(6).

significant risk of leakage' and 'no significant environmental or health risks exist'.[37] A leakage is any release of CO_2 from the *complex,* not the site:[38] CO_2 is expected to 'migrate' or move within the complex.[39]

A detailed 'characterisation' of the complex must be carried out in order to determine its suitability for storage. Pursuant to Annex I,[40] the process of site characterisation essentially involves gathering data so as to construct a computerised three-dimensional model of the storage complex. This is then used to characterise (predict, or map) the movement and behaviour of CO_2. Invasive activities such as drilling into the subsurface may be required for sufficient characterisation. This process of 'exploration'[41] must not be carried out without an 'exploration permit'.[42] Fair access provisions to exploration permits are provided,[43] and priority for the granting of a storage permit is given to the holder of an exploration permit,[44] thus providing the necessary commercial incentives for carrying out these activities.

Storage permit applications, contents and conditions

A permit is required in order to inject and store streams of CO_2 into underground formations.[45] Member States retain the right to not permit CO_2 storage within their territories.[46] Articles 7, 8 and 9 of the Directive provide details of permit applications, conditions and contents. Article 31 includes the operation of geological storage sites within Annex I of the EIA Directive. An assessment will therefore be required for all storage sites and is to be included in the application for a storage permit.[47]

An operator must also provide proof of financial viability, technical competence and reliability,[48] complemented by the fallback requirement to provide adequate financial security to cover the costs of any obligations pursuant to the Directive.[49] This financial security is to be valid and effective before the commencement of injection until the transfer of responsibility to the competent authority.[50]

Permits are also required to contain information as to composition of CO_2 'streams',[51] the flow of substances that results from the CO_2 capture process.[52] In recognition of the existence of impurities from capture, Article 12 requires CO_2 streams to consist 'overwhelmingly' of CO_2, permitting substances which are 'incidental' to capture processes. Criteria are also provided as to concentrations of these extra substances in order to provide protection for the storage site, transport infrastructures, the environment and

37 Article 4(4). 'Significant risk' is defined in Art. 3(18) as a combination of a probability of occurrence of damage and a magnitude of damage that cannot be disregarded without calling into question the purpose of the Directive.
38 Article 3(5).
39 See Art. 3(16).
40 Article 4(3).
41 Defined in Art. 3(8).
42 Article 5(1) defined in Art. 3(9).
43 Article 5(2).
44 Article 6(3).
45 Article 6(1). Definition of geological storage provided in Art. 3(1).
46 Article 4(1).
47 Article 7(9).
48 Articles 7(2) and 8(1)(b).
49 Article 19(1).
50 Articles 19(1) and (3)(a).
51 Article 7(4).
52 As defined in Art. 3(13).

human health.[53] The operator must carry out a risk assessment of CO_2 streams and maintain a register of their quantities, properties and composition.[54]

Draft storage permits must be submitted to the Commission, who may issue a non-binding opinion within relevant timescales.[55] Competent authorities may depart from the opinion provided they state their reasons for doing so.[56]

Operation, compliance and liability

Once a storage permit has been granted, the operator may commence injection of CO_2 into the storage site. This period of operation is characterised by a regime of monitoring, reporting and inspection in order to detect leakage, significant irregularities[57] and any adverse effects on the surrounding environment.[58] The storage complex must be monitored by operators in accordance with the approved monitoring plan compiled pursuant to Annex II.[59] The plan is a living document subject to periodic updating.[60] The obligation on operators to report,[61] together with duties on competent authorities to inspect storage sites,[62] will provide important secondary verification of monitoring activities.

Article 11 of the Directive ensures that the storage permit itself is also a living instrument. The competent authority is required to review, and where necessary update, or, as a last resort, withdraw storage permits *inter alia* periodically and when it has been notified or made aware of leakages.[63] The operator is also required to notify the authority immediately of any leakages or significant irregularities.[64] If the competent authority decides to withdraw a storage permit, it must either issue a new permit or close the site.[65] In either case, the competent authority shall take over all legal obligations and liabilities relating to management of the site.[66]

When a significant irregularity or leakage occurs, 'corrective measures' must be implemented by the operator (or the competent authority if the permit has been withdrawn) in accordance with the approved corrective measures plan.[67] Corrective measures are any actions taken to prevent or stop release of CO_2 from the storage complex.[68] The obligation to carry out corrective measures, including measures to protect human health, is included within the permit and is therefore a *compliance* issue.[69] In contrast, actions to prevent damage to the environment are not dealt with as a compliance matter, but rather as a *liability* to prevent and remediate 'environmental damage'

53 Article 12(1).
54 Article 12(3).
55 Article 10.
56 Ibid.
57 That is, irregularities in the operations of storage or injection or the condition of the storage complex itself, as defined in Art. 3(17).
58 Article 13(1)(c), (d) and (e).
59 Articles 7(6), 9(5) and 13(1).
60 Article 13(2).
61 Article 14.
62 Article 15.
63 Article 11(3).
64 Article 16(1).
65 Article 11(4).
66 Ibid.
67 Article 16(1) read with Art. 11(4).
68 As defined in Art. 3(19).
69 Article 9(6).

under the Environmental Liability Directive (ELD).[70] Symbolically, this is problematic, but also practically. Quite significantly, the authority is compelled under Article 16(4) of the CCS Directive to carry out corrective measures if the operator fails to do so, but through reliance on the ELD for preventing environmental damage, the corresponding preventative duty on the authority does not apply.[71] Moreover, close reading of Article 34 of the CCS Directive suggests that environmental damage caused by the transport of CO_2 may not come within the ELD regime. Additionally, the ELD's limitation period on liability of 30 years may prove problematic in view of the long timescales involved in CO_2 storage.[72]

Financial liability for leakage of CO_2, or 'climate damage', is imposed through the requirement to surrender purchased allowances under the ETS.[73] However, the requirement to buy credits 'is not a penalty in itself',[74] and a relatively low carbon price may fail to address any financial gain which could be garnered from a failure to remedy leakages. It might have been better to explicitly address climate damage within the rules required under Article 28, which stipulates the importance of penalties being 'dissuasive' in a way which is not guaranteed under the ETS.

Closure, post-closure and transfer of responsibility

Article 17 lays down the conditions for 'closure': 'the definitive cessation of CO_2 injection into the site'.[75] Very little detail is provided, though the operator is responsible for sealing the storage site and removing injection facilities.[76] Closure is to take place in accordance with the definitive post-closure plan, reviewed and updated prior to closure in accordance with Annex II.[77] The operator remains responsible for monitoring, reporting and corrective measures, and is subject to liability under the ELD and ETS, until the site is transferred to the operator.[78]

In view of operators being reluctant to accept responsibilities and liabilities in perpetuity, Article 18 provides for the transfer of responsibility for the storage site to the competent authority.[79] The responsibilities transferred to the competent authority are obligations relating to monitoring, corrective measures, the surrender of allowances under the ETS and liability pursuant to the ELD.[80] The transfer does not include costs incurred by the competent authority involving fault on the part of the operator, including deceit, negligence or deficient data.[81]

The overriding criterion for transfer is that 'all available evidence indicates that the stored CO_2 will be completely and permanently contained'.[82] It has been suggested that 'complete

70 Environmental Liability Directive 2004/35/EC, Arts 4 and 5. Definition of environmental damage is in three categories, relating to biodiversity, water and land, Art. 2(1). See also Art. 34 CCS Directive.
71 See ELD, Art. 5(4).
72 ELD, Art. 17. See also Client Earth, 23.
73 As above.
74 Client Earth, 24.
75 Article 3(20).
76 Article 17(2).
77 Article 17(3).
78 Article 17(2).
79 See also Acceptance of CO_2 Capture, Storage Economics, Policy and Technology Report (ACCSEPT, 21 December 2007), 'Summary of Key Findings', available at ,http://www.accsept.org/outputs/wp_5_2dec_2007_final.pdf>.
80 Article 18(1).
81 Article 18(7). Such costs are to be recovered by the competent authority from the operator.
82 Article 18(1)(a).

containment' would be impossible to show,[83] although it would seem that 'all available evidence indicating' is less demanding than, say, 'proof of' complete containment, although no guidance is given as to the meaning of 'all available evidence'.

The Directive also provides a minimum default period of at least 20 years between closure and transfer to the state.[84] There is no limitation period on responsibility for the operator, so that an operator may actually be subjected to liability in perpetuity if it is unable to match the storage integrity criterion for transfer, which may, or may not, be 'impossible' to show. Prior to transfer of responsibility the operator must also make a financial contribution available to the competent authority to cover at least the anticipated cost of monitoring for a period of 30 years after the transfer.[85] When satisfied that these conditions are met, a draft decision of transfer is to be submitted to the Commission, who may issue a non-binding opinion on it.[86] After the transfer, in accordance with the precautionary principle,[87] monitoring may be reduced but not ceased.[88]

CONCLUSION

The permitting process in the new Directive provides a reasonably comprehensive regime for the detection of storage problems, with detailed site characterisation providing a firm basis for monitoring, reporting and inspection activities. This proactive approach is arguably undermined by the responses the Directive provides to the detection of leakage, with a limited notion of compliance compelling reliance on inadequate and inappropriate existing regimes. Given the uncertainties associated with CCS operating on commercial scales, this is unfortunate.

Interestingly, the main success of the Directive, namely, environmentally safe storage of CO_2 in the longer term (millennia), is contrasted with the much shorter timescale envisaged for technically and economically 'proving' the technology on a commercial scale (on some estimates within 20 years); one might be concerned with the size of this mismatch, even though the aim of *permanent* storage will always carry a certain level of uncertainty. It is to be hoped, therefore, that the iterative process of monitoring and reporting provided by the Directive affords, within these coming 20 years, sufficient understanding of storage in the longer term with which to justify the anticipated widespread deployment of CCS after 2025. The Commission's review of the Directive in 2015 under Article 38, in particular of CCR and an EPS, will be an important milestone in the development of the technology. This short timescale for determining the success of CCS as a climate change mitigation option will arguably also heighten the importance of the role of the Commission in exchanging information between competent authorities.[89]

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83 Client Earth, 17.
84 Article 18(1)(b).
85 Articles 18(c) and 20(1).
86 Article 18(4) and (5).
87 C. Hendriks, M.J. Mace and R. Coenraads, *Impacts of EU and International Law on the Implementation of Carbon Capture and Geological Storage in the European Union* (Field and Ecofys: June 2005).
88 Article 18(6).
89 Articles 4(2) and 27.
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