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The Legal Issues behind Stagnating CCS Deployment in the European Union — Is it the Member States' Turn?

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The Legal Issues behind Stagnating CCS Deployment in the European Union — Is it the Member States' Turn?

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Even though the European Union decided to promote carbon (dioxide) capture and storage (CCS) as part of its greenhouse gas emission mitigation portfolio and it enacted a directive eight years ago in order to speed up the safe deployment of this technology, there is no functioning project yet in the EU. While this is a well understood technology with an important emission reduction potential, it requires a legal regime which affords sufficient certainty to operators about their potential liabilities. However, the European legal framework is perceived as achieving the opposite effect. The present paper considers that a way to overcome the industry's difficulties is more Member State action in the form of pragmatic interpretation and tailor-made agreements.

Keywords: CCS, EU, liability, interpretation

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1 Introduction

Carbon (dioxide) capture and storage (CCS) is a technology whereby carbon dioxide is separated from flue gases at large emission sources like power stations and factories, compressed, and injected into geological formations like depleted oil and gas fields, saline aquifers, and basalt formations. The technology required is both well understood from similar operations, such as enhanced oil recovery (EOR) and natural gas storage, and it is the subject of ongoing research in the specific CCS context. The main attraction of this technology is its potential contribution to the reduction of greenhouse gas emission necessary for mitigating climate change while it allows the later phase-out fossil fuels. Indeed, it has been shown by several studies[1] that the role of CCS is critical in reducing greenhouse gas emission to the required level and meeting the 2°C target of the Paris Agreement.[2]

However, the deployment of this technology stagnates in Europe despite the political support from Brussels. There seem to be two reasons for this. The first is that CCS is a costly technology. The compression of carbon dioxide, its transport (by pipeline or ship), and its injection all demand energy. Also, there is an energy penalty, ie a power plant capturing carbon dioxide uses energy for this and thus it is less efficient. This makes the establishment of the business case difficult. It is hoped that soon the European carbon emission trading scheme will provide a sufficient financial incentive.[3] Economic feasibility is only one of the crucial aspects of any new technology. Supportive policy and an appropriate legal framework, especially regarding liability, are equally important. The European Union was the first to create a legal framework in the form of the CCS Directive.[4] However, this has been criticized on several grounds and blamed as an obstacle to

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1 See for example: International Panel on Climate Change (IPCC), 'Fifth Assessment Report, Climate Change 2014, Synthesis Report' (2014), found at < https://www.ipcc.ch/report/ar5/>.

2 Adoption of the Paris Agreement (FCCC/CP/2015/L9/Rev 1, 12 December 2015); the Paris Agreement is a key document designed for enhancing the implementation of the UNFCCC by 'holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C, increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production', and 'making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development' (art 2, Paris Agreement, FCCC/CP/2015/10/Add 1). The Paris Agreement entered into force on 4 November 2016.

3 CCS may also be profitable in other ways. For example, where it is deployed to avoid carbon tax as it is the case in Norway or where the captured CO_2 is sold for enhanced oil recovery as in SaskPower's Boundry Dam project in Canada.

4 Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide, [2009] OJ L140/114.

the deployment of CCS. Most notably, it is considered that certain definitions are not sufficiently precise and the financial requirements are too burdensome. This means in turn that operators face uncertainty regarding the extent of their risk. Despite the criticisms, in 2015 at the review[5] of the CCS Directive the decision was made to not open the procedure for amendment.[6] Thus, any substantial change to the European framework is unlikely in the near future. Therefore, after a brief overview of the European legislative framework and the concerns of the industry, the present article considers an approach which attempts to overcome the current impasse. Member States and the industry need to cooperate closely with site-specific agreements and give commercially reasonable meaning to the CCS Directive's terms.

2 The liability framework in the European Union

The CCS Directive is a specific instrument for this activity which also includes it into the EU's environmental liability framework (the Environmental Liability Directive[7] or ELD) and the European emission trading scheme (the ETS Directive[8]). These three instruments have already been described by other authors,[9] therefore a brief overview is sufficient here.

The CCS Directive has two key elements. First, it prescribes a permit regime for the storage.[10] This regime contains rights and obligations for the permit holder. The obligations apply during the period of operation of the CCS facility and even after its closure. Second, the Directive also provides that these obligations are transferred to the State after the passage of a certain amount of time and upon the satisfaction of certain conditions. The provisions of the CCS Directive

5 As prescribed by art 38.

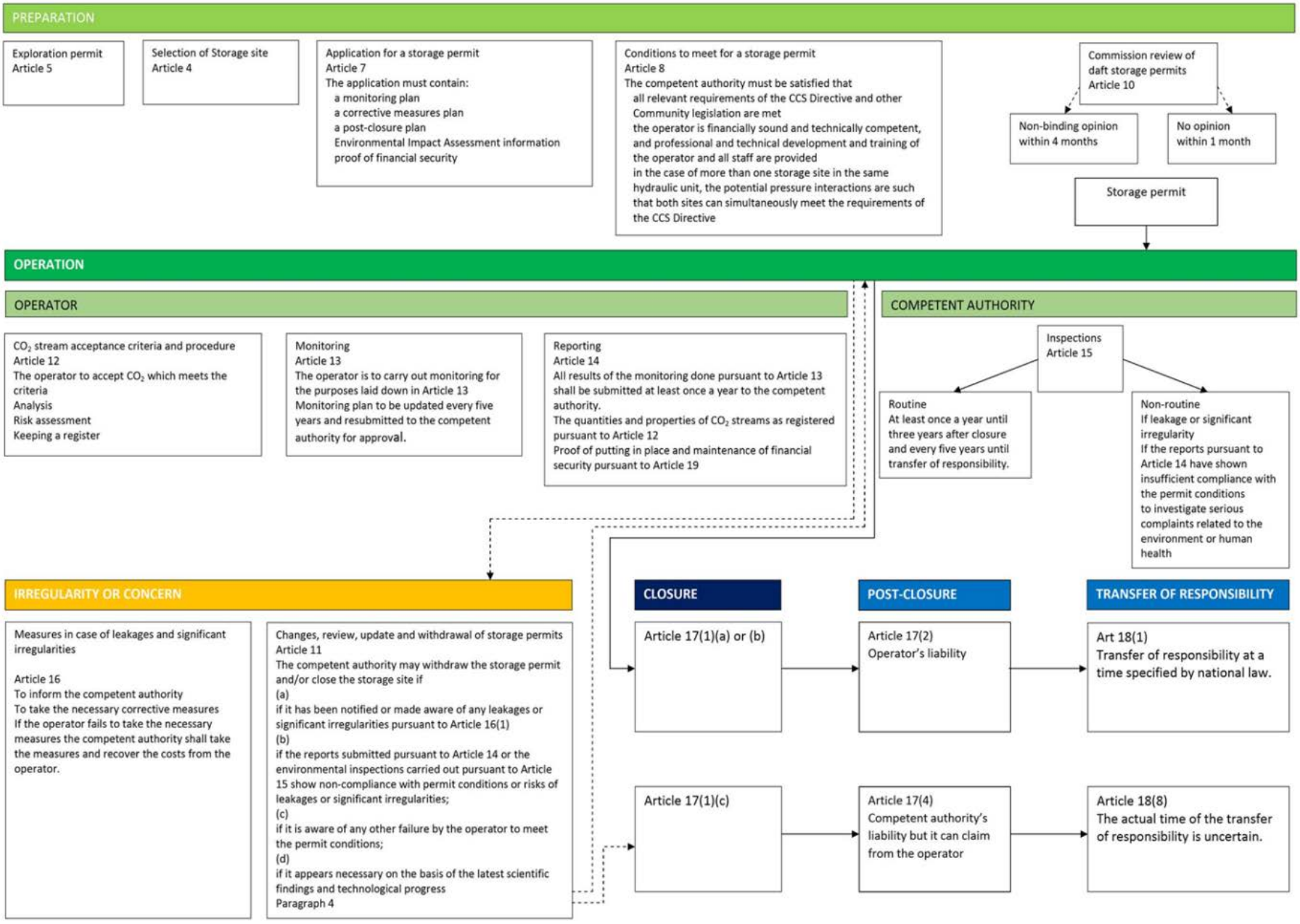
6 European Commission Report on review of Directive 2009/31/EC on the geological storage of carbon dioxide of 11 November 2015, COM(2015) 576 final.

7 Directive 2004/35/EC of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage, [2004] OJ L143/56.

8 Directive 2003/87/EC of 13 October 2003 on establishing a scheme for greenhouse gas emission allowance trading within the Community, OJ L275/32 as amended by Directive 2009/29/EC of 23 April 2009 on amending Directive 2003/87/EC, OJ L140/63.

9 See for example: C Bradshaw, 'The new Directive on the Geological Storage of Carbon Dioxide' (2009) Environmental LR 196.

10 The capture and transport phases of CCS are considered only tangentially by the Directive.


PREPARATION
Exploration permit
Article 5
Selection of Storage site
Article 4
Application for a storage permit
Article 7
The application must contain:
a monitoring plan
a corrective measures plan
a post-closure plan
Environmental Impact Assessment information
proof of financial security
Conditions to meet for a storage permit
Article 8
The competent authority must be satisfied that
all relevant requirements of the CCS Directive and other Community legislation are met
the operator is financially sound and technically competent, and professional and technical development and training of the operator and all staff are provided
in the case of more than one storage site in the same hydraulic unit, the potential pressure interactions are such that both sites can simultaneously meet the requirements of the CCS Directive
Commission review of daft storage permits
Article 10
Non-binding opinion within 4 months
No opinion within 1 month
Storage permit
OPERATION
OPERATOR
COMPETENT AUTHORITY
CO_2 stream acceptance criteria and procedure
Article 12
The operator to accept CO_2 which meets the criteria
Analysis
Risk assessment
Keeping a register
Monitoring
Article 13
The operator is to carry out monitoring for the purposes laid down in Article 13
Monitoring plan to be updated every five years and resubmitted to the competent authority for approval.
Reporting
Article 14
All results of the monitoring done pursuant to Article 13 shall be submitted at least once a year to the competent authority.
The quantities and properties of CO_2 streams as registered pursuant to Article 12
Proof of putting in place and maintenance of financial security pursuant to Article 19
Inspections
Article 15
Routine
At least once a year until three years after closure and every five years until transfer of responsibility.
Non-routine
If leakage or significant irregularity
If the reports pursuant to Article 14 have shown insufficient compliance with the permit conditions
to investigate serious complaints related to the environment or human health
IRREGULARITY OR CONCERN
CLOSURE
POST-CLOSURE
TRANSFER OF RESPONSIBILITY
Measures in case of leakages and significant irregularities
Article 16
To inform the competent authority
To take the necessary corrective measures
If the operator fails to take the necessary measures the competent authority shall take the measures and recover the costs from the operator.
Changes, review, update and withdrawal of storage permits
Article 11
The competent authority may withdraw the storage permit and/or close the storage site if
(a)
if it has been notified or made aware of any leakages or significant irregularities pursuant to Article 16(1)
(b)
if the reports submitted pursuant to Article 14 or the environmental inspections carried out pursuant to Article 15 show non-compliance with permit conditions or risks of leakages or significant irregularities;
(c)
if it is aware of any other failure by the operator to meet the permit conditions;
(d)
if it appears necessary on the basis of the latest scientific findings and technological progress
Paragraph 4
Article 17(1)(a) or (b)
Article 17(2)
Operator's liability
Art 18(1)
Transfer of responsibility at a time specified by national law.
Article 17(1)(c)
Article 17(4)
Competent authority's liability but it can claim from the operator
Article 18(8)
The actual time of the transfer of responsibility is uncertain.

and post-closure. The last stage can be further divided into pre-transfer and post-transfer of responsibility. The following diagram illustrates these stages and outlines their main features.
The CCS Directive provides for three types of liability: liability for corrective measures, liability for environmental damage, and liability for climate damage arising from leakage. Under art 16 of the CCS Directive the operator must take corrective measures in case of leakages and significant irregularities. Similarly, the operator must take preventive action or remedial action under the ELD where there is an imminent threat or actual environmental damage. Further, carbon dioxide emission allowances have to be surrendered in accordance with the ETS Directive for any leaked CO_2. Under art 18 of the CCS Directive, these liabilities are transferred to the State after the closure of the storage site, the passage of a certain amount of time (20 years by default), and on meeting certain conditions.

Article 19 of the CCS Directive demands the operator to provide financial security in order to cover 'all obligations arising under the permit issued pursuant to [the] Directive, including closure and post-closure requirements, as well as any obligations arising from inclusion of the storage site under [the ETS Directive]'. Under art 20 of the CCS Directive, the operator is also to provide the competent authority with a financial contribution before the transfer of responsibility which is to be used for monitoring and any other expense arising from the maintenance of the storage site.

3 The criticism of the European system

The literature to date on CCS points to several issues in the European legal framework.[11] Some stakeholders consider that the requirement to show 'complete and permanent containment' is too onerous and cannot be met. In practice, it is not certain what constitutes 'leakage' under the CCS Directive. There is concern about how the competent authority will evaluate whether the criteria for the transfer of responsibility have been met. It is not clear what should be included

[11] Most recently, the subject has been treated in detail in A Pop, 'The EU Legal Liability Framework for Carbon Capture and Storage: Managing the Risk of Leakage While Encouraging Investment', (2015) 6 Aberdeen Student LR 32.

and how much the financial security and financial contribution should be. The estimation of emission liability is particularly difficult due to the price evolution of emission allowances. There is no cap on the potential liability. Guidance Document 4 to the CCS Directive on financial security and contribution[12] is considered to be too rigid and demanding.

Pop suggested to resolve the industry's concerns either by introducing a tiered liability system akin to those in the oil and gas industry and the nuclear energy sector, sharing responsibility between the operator, a fund, and the State or by providing more precise definitions and criteria.[13] While setting up a tiered liability system seems to be a good idea for incentivising investment by capping the operator's liability, it would not resolve other uncertainties. Furthermore, the establishment of a fund would require the tying of capital for an activity which at present relies on funding to be barely profitable. It is also uncertain whether this industry is already large enough to set up an effective fund. Perhaps the OPOL scheme[14] could be extended among CCS operators to include this activity where it takes place offshore.

In 2015 the CCS Directive has been reviewed by the Commission. The Commission was aware of the industry's concerns through the consultation preceding the review and the study complied for the review[15] (hereafter 'the review study') in particular. Regarding Guidance Document 4 specifically the study noted: 'given the high level of concern expressed regarding GD4 there appears to be a good case for reviewing any phrases within it that cause most concern for potential storage site developers.' Concluding the review, the Commission reported[16] that the Directive was 'fit for purpose', that 'stakeholders are of the opinion that the Directive provides the regulatory framework needed to ensure safe CO_2 … storage while allowing the Member States sufficient flexibility', that 'stakeholders and Member States consider the Directive

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12 European Commission, 'Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide, Guidance Document 4, Article 19 Financial Security and Article 20 Financial Mechanism' (2011).

13 See A Pop (n 11).

14 The Offshore Pollution Liability Agreement, also known as OPOL, is a voluntary contractual agreement between offshore oil and gas operators to indemnify themselves up to a maximum of US $250,000,000 per incident in case of an incident. See: <http://www.opol.org.uk/about.htm>.

15 European Commission, 'Study to Support the Review and Evaluation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide (CCS Directive)' (2015).

16 European Commission Report on review of Directive 2009/31/EC on the geological storage of carbon dioxide of 11 November 2015, COM (2015) 576 final.

necessary for the safety of geological storage and to provide legal certainty for investors', and that 'the Directive is generally considered to provide a good balance between defining an outline approach at EU level and the Member States developing their own detailed and case-specific interpretation'.[17] Regarding the Directive's financial provisions specifically, it was found that 'articles 19 and 20 … give Member States enough scope to decide how site operators should prove their ability to safely operate and monitor a storage site up to the point of transfer of responsibility to the Competent Authority' and Guidance Document 4 was not mentioned. Thus, new legislation on definitions, criteria, and finance provisions are unlikely in the near future. How can the Commission's view be so much at odds with the scholarship and stakeholder publications to date? What can be done to address the concerns of the industry?

4 An old-new understanding of the CCS legal framework

The Commission's standpoint is that as matter of European law a directive is for giving legislative guidelines as opposed to precise rules and the Commission considers that this task is fulfilled well by the CCS Directive. After implementation, the responsibility switches back to Member States to enact legislation which complements the implementation of the Directive. Indeed, the review report envisages site-specific rules.

The Commission was also aware of the ROAD project[18] and the study elaborated before the review placed heavy reliance on its success. The ROAD project has gone through the permitting process and the review study noted: '[the project] have agreed workable solutions with the Dutch [competent authority] that both parties appear to accept. This single example suggests that even with GD4 there is … enough flexibility to allow procedures to be agreed and projects

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17 Having said that, the report acknowledges that there is limited experience so far on the Directive's practical implementation and this precludes a robust judgment. For the same reason a REFIT (Regulatory Fitness and Performance) evaluation also could not be carried out.

18 'The Rotterdam Capture and Storage Demonstration Project (ROAD) is an initiative of E ON Benelux and GDF SUEZ Energie Nederland. As of 2015, ROAD plans to capture 1.1 million tonnes of CO_2 per year from a new power plant at the Maasvlakte and will store the captured CO_2 in a depleted gas reservoir under the North Sea. Source: <http://road2020.nl/en/>.

to be advanced…'.[19] Falling in line with the Commission's opinion in the review report, one of the main lessons from the ROAD project is that CCS legislation should be as general as possible in order to allow a tailor-made approach.[20] The requirements should be based on the specific characteristics of each storage site. The project does indeed show how certain questions can be answered. Financial security must cover monitoring, contingency monitoring, abandonment, the financial contribution, and EU emission allowances in case of leakage.[21] The amount of security for emission liability has also been agreed.[22] Furthermore, it turned out that complying with the monitoring requirements is easier than it was initially thought.[23] The financial contribution was agreed to cover monitoring costs only.[24] Regarding the financial security instruments, the Dutch government currently accepts balance sheets but in the future it will prefer bank or parental guarantees.[25]

While the ROAD project certainly achieved an important progress, putting too much emphasis on it is at least arguably complacent. Certain threads remained unsewn. Most importantly, the criteria to be met before the transfer of responsibility can take place. In addition to the administrative uncertainty, it appears from the project's assessment that in scientific terms the default 20 year pre-transfer period is not justified.[26] Meanwhile, it makes the required financial security more expensive by covering a longer time which is also a time when the operator is not making profit anymore from CCS. Also, the project pointed to issues which should have been addressed during the Directive's review.[27] The development of the ROAD project should be

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19 Review Study (n 15) 73.

20 ROAD CCS, 'Case study of the ROAD storage permit, A report by the ROAD project - part of the European CCS Demonstration Project Network', (2013) found at: <http://hub.globalccsinstitute.com/sites/default/files/publications/111356/case-study-road-storage-permit.pdf>, at 4; see also: slides presented by T Jonker, 'What has ROAD learnt about CCS regulation and how can these lessons be applied?' at 5th IEA International CCS Regulatory Meeting, Paris, 18-19 June 2013, found at: <https://www.iea.org/media/workshops/2013/ccs/regnet/8_JonkerROAD.pdf>.

21 ROAD CCS (n 20) 21.

22 Ibid s 4.4.2.

23 T Dixon, S T McCoy, I Havercroft, 'Legal and Regulatory Developments on CCS', (2015) 40 International Journal of Greenhouse Gas Control 431, 445.

24 ROAD CCS (n 20) 25.

25 Ibid 24.

26 Ibid 26-28.

27 T Jonker, 'Permitting Process, Special Report to the Global Carbon Capture and Storage Institute', (2013) found at: <http://hub.globalccsinstitute.com/sites/default/files/publications/94946/permitting-process-special-report-getting-ccs-project-permitted.pdf>, s 6.

contrasted with the halted[28] UK CCS Commercialization Programme. Stakeholders considered that the majority of the risk would have to be borne by the government, that most risks are quantifiable and can be insured against but the insurance would be limited in time and capped, and that emission liability was not quantifiable.[29] Guidance Document 4 on the financial provisions was seen as too onerous and even on a pragmatic interpretation the required securities, if finalized, could have been too high.[30] There was also uncertainty as to what instruments can be used for financial security.[31]

In this light, considering that the ROAD project is sufficient evidence that CCS projects can proceed with the current legislation is barely warranted. Opening the CCS Directive for amendment may make it politically vulnerable and it is understandable if the Commission prefers to safeguard the framework achieved so far. However, an attempt should be made at amending at least the Guidance Documents, taking into account the industry's concerns. These projects show that even though in theory the turn is with the Member States, it is an especially difficult task to interpret the current European legislation in a way which enables the realization of a CCS project. With a more active State role in mind, the followings will analyse in detail various parts of the CCS Directive.

5 Permanent containment and leakage

5.1 Permanent containment

28 This project stopped due to the withdrawal of £1 bn government funding. See: D Carrington, 'UK cancels pioneering £1bn carbon capture and storage competition', *The Guardian* (25 November 2015), found at <https://www.theguardian.com/environment/2015/nov/25/uk-cancels-pioneering-1bn-carbon-capture-and-storage-competition>.

29 P Dixon and T Mitchell for the Carbon Capture and Storage Association, 'Lessons Learned, Lessons and Evidence derived from UK CCS Programmes, 2008-2015' (2016), found at <http://www.ccsassociation.org/press-centre/reports-and-publications/lessons-learned/>.

30 Ibid.

31 Ibid.

One of the most often evoked impasses for CCS is the requirement of 'complete and permanent containment' before liability can pass to the State. Article 18 of the CCS Directive requires 'all available evidence [to] indicate that the stored CO_2 will be completely permanently contained'.[32] It has been questioned already during the legislative procedure of the CCS Directive whether commercially this can support the development of CCS.[33] Macrory understood this test to be a 'particularly tough' one and noted that the wording of the condition 'may require some common sense rather than literal interpretation if it is ever to be exercised'.[34] On the other hand, Bradshaw noted that the expression 'all available evidence indicates' is more lenient than for example 'proof of'.[35, 36] According to the review study, there is a lack of consensus among stakeholders on the definition of permanent containment. Three opinions seem to be discernible. The first is the strict, literal interpretation. The second is a more lenient interpretation which accommodates in the words of the Directive the current limits of science and engineering. However, this group awaits an authoritative confirmation of the correctness of this approach. The third interpretation also takes CCS technology's limits as part of the definition and it considers this interpretation to be correct based on the way the CCS Directive was drafted. As the review study found,

> some [respondents] suggest[ed] that further clarification may not be needed given widespread understanding derived from the Directive as it stands: 'There is widespread agreement across jurisdictions that risk assessment and risk management processes should be used to select appropriate storage sites with excellent integrity, and design/operate/monitor storage sites so as to minimize any risks associated with leakage, and provide assurance of effective long term containment.'

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32 Article 18, para 1(a); CCS Dir.

33 See further: Opinion of the European Economic and Social Committee on the Proposal for a Directive of the European Parliament and of the Council on the geological storage of carbon dioxide of 3 February 2009, OJ C27/75, at 5.7.3, 5.7.4, 5.14, 5.14.1, 5.14.2.

34 R Macrory, 'Capturing the legal arguments' (2009) 88 European Lawyer 47.

35 C Bradshaw (n 9) 203.

36 However, on a strict interpretation, once it is possible to run simulations which indicate a very small likelihood of leakage (as it is the case), it is not possible to say anymore that *all* evidence indicates complete and permanent containment.

Indeed, a strict interpretation may not be appropriate. The Directive itself supports this view. Article 4, para 4 (selection of storage sites) provides:

> A geological formation shall only be selected as a storage site, if under the proposed conditions of use there is *no significant risk* of leakage, and if no significant environmental or health risks exist.

It is clear from this paragraph that some risk of leakage is contemplated at the site selection stage.[37] If so, it is reasonable to expect the same risk on site closure and later on. In effect, the requirement in art 18(2) becomes 'all available evidence indicating no significant risk that the stored CO_2 will not be completely and permanently contained'.

While no scientific study so far could guarantee complete and permanent containment, research to date suggests that the risk of leakage is very small.[38] Furthermore, if complete and permanent containment could be guaranteed in the strictest sense, there would remain little justification for demanding funds for the financial mechanism under art 20 of the CCS Directive or the transfer of liability in the first place. If the Directive contemplates some risk from the site selection stage into perpetuity, the highest demand it can pose at the transfer of liability stage is a very small risk. As opposed to the strict approach, the interpretation offered here keeps the Directive consistent on this point.

The Commission's Guidance Document 3 to the CCS Directive[39] seemingly maintained the language of the Directive. It confirms that operators can demonstrate permanent containment

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37 See also: C Hughes, 'CCS: Legislating to quantify risk and increase the financial viability of CCS projects', UCL Think Piece, found at <http://blogs.ucl.ac.uk/law-environment/files/2012/12/Think-piece-6-Hughes.pdf>.

38 For example, the ECO2 project (<http://www.eco2-project.eu/>) has examined two real CO_2 storage reservoirs — Sleipner and Snøhvit — under the North Sea. These two sites did not leak to date (operating from 1996 and 2008 respectively). While it is possible to run simulations on the geological models of these areas which demonstrate leakage scenarios (see the results of Work Package 1 of the ECO2 project) and therefore in scientific terms the possibility of leakage cannot be excluded, such leakages are very unlikely (personal communication with Prof Dr Christian Berndt (GEOMAR, ECO2), 01 Feb 2015). Also see: IPCC Special Report on Carbon Dioxide Capture and Storage (2005), found at <https://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf >, s 5.7.3.

39 European Commission, 'Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide, Guidance Document 3, Criteria for Transfer of Responsibility to the Competent Authority' (2011), at 4 especially.

by meeting at least the three conditions listed in art 18(2) (conformity with the models, no detectable leakage, and storage site evolution towards stability). However, the Document also provides:

> A key aspect of containment is that there are no detectable leaks from the storage complex, including leakage through geological or man-made structure (see GD1). There should be no observed leakages from any existing or abandoned wells. This may be assessed by the operator demonstrating that … there are no leakages for a continuous 10 year period immediately before the time of transfer. If a successful corrective measure has taken place (as [a] result of leakage), the 'clock' for the ten year time period would start over from the point in time when the corrective measure has been proven successful. *This would allow the CA to have sufficient confidence that the site would not leak again.*[40]

This guidance tempers the 20 year waiting period after the closure of the storage site in that there must be no leakage only in the last ten years before the transfer of responsibility.[41] Much more importantly, it tells us that a period of 10 years with no leakage will amount to evidence for complying with the 'complete and permanent containment' criterion; the CO_2 will be deemed to have been stored completely and permanently. This is an important statement for two reasons. First, it shows that the Directive does not demand proof of absolutely no leakage. It requires 'sufficient confidence' that the site will not leak. Second, it gives the 10 year period as a tangible benchmark through which operators can meet the 'complete and permanent containment' requirement. According to the interpretation proposed here, the storage sites must be selected according to strict criteria and they must perform as expected. If so, the responsibility for the site is handed over to the competent authority who assumes a minimal risk stemming from the nature of CCS. Although the guidance documents are not legally binding

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40 Ibid 8, italics by the present author.

41 Two interpretations of this guidance are possible. Emphasis may be placed on the expression 'existing or abandoned wells'. In this case, it would be applicable only to wells and the term 'site' in the final sentence would have to be read as 'the site through a well'. Alternatively, since the first sentence refers to the storage complex, the second to wells, and the last to the storage site, all in the same context, the guidance is general and the exact choice and order of words is not important here. It is on this latter interpretation, that the guidance means that even in the default 20 year minimum period only during the second ten years there must be no leakage from the storage complex. This interpretation is confirmed by the subsequent text of the section by discussing both wells and the storage complex.

instruments, they are authoritative sources on the interpretation of the CCS Directive. Member States can differ in its interpretation and implementation; a different number of years may be prescribed for example. The stakeholder meeting of the review study opined that the theoretical concerns arising from the definition of permanent storage will not halt CCS projects because these 'can be addressed via practical discussions during implementation'.[42] Member States are at freedom to reassure their respective industries if they follow an approach akin to the one here set out either through legislation or government papers.

5.2 Leakage

Given the importance of 'complete and permanent containment', it is particularly important to know when a leakage takes place. The concept of leakage is much broader than the escape of carbon dioxide into the atmosphere or the water-column. The CCS Directive defines leakage in terms of release of CO_2 from the 'storage complex'. The 'storage complex' in turn consists of the 'storage site' and the 'secondary containment formations'. Once carbon dioxide leaves the secondary containment formations, the definition of leakage is met.[43] Consequently, by the time the carbon dioxide reaches even the near-surface or the seafloor sediments, the fact of leakage is established.[44] It follows that it has to be known exactly what a secondary containment formation is. It emerges from the CCS Directive that it is the surrounding geological domain of the storage site which can have effect on overall storage integrity and security.[45] Guidance Document 2 of the Commission states further that

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42 The Review Study (n 15) 4.5.3.

43 See also C Bradshaw (n 9) 200.

44 The obvious implication is that sub-soil monitoring will be more important than the monitoring of CO_2 concentration in the air or water column. Detectability varies as a function of depth (ECO2, WP1 result summary report relevant for 'Environmental Best Practice', Deliverable 1.2, 05.11.2014, at 20). Currently, at shallow depth (less than 500 m) amounts as small as 300 tonnes of gaseous CO_2 may already be detectable (Ibid 22).

45 Article 3, para 6.

> it is expected that [the] operator will provide the [competent authority] with the specific vertical and areal extent of the geological formation(s) into which injection will take place, as well as [the] defined boundaries of the storage complex[46]

and it recognizes that the precise size of the complex may vary in light of the actual behaviour of the injected CO_2.[47] Guidance Document 3 states: 'the definition of leakage is contingent on the geological strata that are considered to be part of the storage complex'[48] and notes that models in general operate with certain error bars.[49] It provides in relation to 'evolution towards long term stability' that

> [f]or model scenarios that show leakage, the value of the parameters (or combination of parameters) that may cause a leak should be far (e.g. two standard deviations) from expected values.[50]

Thus, the definitions of the storage complex and leakage are not ready-made and they are linked. Pop argued that the arising ambiguity is undesirable.[51] However, it is considered here that this solution may, in fact, help the operator. Each storage site is different and their boundaries need to be established on a case-by-case basis in a highly technical manner. It appears from the guidance documents and the Directive that it is the operator with the competent authority who are responsible for setting out and for revising the boundaries of the storage complex. Since the operator plays an active part in the design of the storage complex, it is unlikely that it will not have a clear idea of what would constitute leakage.

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46 European Commission, 'Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide, Guidance Document 2, Characterisation of the Storage Complex, CO_2 Stream Composition, Monitoring and Corrective Measures' (2011), at 25.

47 Ibid 26-27.

48 Guidance Document 3 (n 39) 8.

49 Ibid 4-6.

50 Ibid 10.

51 A Pop (n 11) 52.

6 The amount of the financial security and capping liability

The biggest legal impediment to CCS projects appears to be that the potential liability is uncertain. Among the various elements, emission liability is particularly difficult to estimate. Indeed, the resulting sum may be an unaffordable risk. It has been shown above that the commission understands 'complete and permanent containment' to be satisfied on the passage of a ten year period without leakage and conformity with the storage site's models. This is a more reasonable requirement than reading the phrase in its strict sense. Arguably, the financial provisions of the Directive should be read with similar liberty. Similarly to the ROAD project, a reasonable estimate needs to be established as to how much CO_2 may escape at various points in time, taking into account that the operator (and the competent authority in case of default) is under a duty to stop leakages. This way the financial security provision would be understood to cover reasonably expectable contingencies. Member States supporting CCS may designate the sum so obtained as the limit to which the operator may be exposed (as periodically revised) and make the residual risk of greater liability rest with the State. Considering the risks of climate change and the difficulty of reducing greenhouse gas emissions and the potential of CCS in contributing to these reductions, Member States and society should be ready to take on this risk.[52]

7 The art 20 contribution

The interpretation of art 20 of the CCS Directive demands a short note. Under this provision the operator must hand over a financial contribution to the competent authority when the responsibility for the storage site is transferred. The amount must be sufficient for monitoring the storage site for 30 years. The article also provides:

> This financial contribution may be used to cover the costs borne by the competent authority after the transfer of responsibility to ensure that the CO_2 is completely and permanently contained in geological storage sites after the transfer of responsibility.

[52] See also A Pop (n 11) 55.

The ROAD project discussed above understood this to mean that in fact operator's liability is potentially unlimited.[53] It is submitted here that this is a wrong interpretation. The quoted part is addressed to the Member State and not the operator. That is, the Member State shall enact legislation which allows it to draw on the financial contribution for other purposes than monitoring (even if only monitoring costs were requested at the transfer), namely, corrective measures. Once responsibility has been transferred from the operator, it is free from responsibility. Otherwise, the purpose of the art 18 responsibility transfer mechanism would be negated. This line of thought is subject to art 17, para 7 whereby responsibility may reattach in case of negligence etc. Admittedly, the last sentence of this provision is unfortunate: 'without prejudice to Article 20, there shall be no further recovery of costs after the transfer of responsibility.' This must be understood as a reinforcement of the above interpretation in that the competent authority is allowed to use the financial contribution provided by the operator for other purposes than monitoring and not as permission for demanding further contribution.

8 ELD liability under the financial security

CCS activities are clearly subject to the ELD.[54] However, whether ELD liability needs to be covered by the financial security demands some consideration. In the meaning of art 19, the financial security must cater for

> all obligations arising *under the permit* issued pursuant to [the] Directive, *including* closure and post-closure requirements, as well as any obligations arising from inclusion of the storage site under [the ETS Directive].[55]

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53 ROAD CCS (n 20) 25; See also: Review Study (n 15) at s 4.18.1.1 and n 51, here the interpretation of art 20 is uncertain.

54 Article 34 of the CCS Directive amends the ELD to include CCS in its Annex III activities attracting strict liability, that is, the operator is to be held liable even if they have not been at fault or negligent.

55 Italics by the present author.

Unlike the ETS Directive, the ELD is not mentioned expressly in art 19. The permit must include a 'corrective measures plan' (art 9, para 6). 'Corrective measures' are measures taken to correct significant irregularities (art 3, para 19). A 'significant irregularity' is any irregularity which implies the risk of leakage or risk to the environment or human health (art 3, para 17). Thus, 'preventive measures' (art 2, para 10 and art 5) under the ELD may also count as corrective measures under the CCS Directive. Similarly, 'remedial measures' (art 2, para 11 and art 6) under the ELD may also come under the corrective measures of the CCS Directive. However, this interpretation is not spelled out by the CCS Directive.

Article 19 also requires provision for the closure and post-closure requirements. The use of the word 'including' seems to indicate that these must be covered only inasmuch as they come under the storage permit. The permit must include the conditions for closure and the approved provisional post-closure plan (art 9, para 7). Article 17, para 2 does state expressly that the operator remains liable for ELD liability after the closure of the storage site. Similarly to the definition of corrective measures, it is conceivable that the post-closure plan contains provisions as to ELD liability. However, again, this is not stated expressly. If this is not the case, the obligation in art 17, para 2 is not arising under the permit as such.

With these points in mind, three interpretations are possible. First, the omission of express reference to the ELD in art 19 and the permit requirements is accidental and ELD liability should be understood to come under the financial security. Second, the omission is deliberate and ELD liability need not be covered by art 19, not even as an art 17, para 2 post-closure obligation because it is not an obligation under the storage permit as such. Thirdly, it may be argued that ELD liability is not coming under the storage permit but it is a post-closure obligation and therefore the financial security should cover ELD liability after the closure of the storage site. This interpretation would ignore the word 'including' (ie the items to be covered by art 19 are those coming under the storage permit and the ETS Directive) and therefore it seems to be unwarranted and should not be followed. The first interpretation seems to be in line with the purpose of the Directive the most. However, it is not sufficiently certain that this was the intended reading.

It adds to the uncertainty that Guidance Document 4 mentions ELD liability only in relation to art 20 as an example of what may be required by the competent authority to be included in the financial contribution.[56] On the other hand, the competent authority can draw on the financial security for complying with ELD liability where it intervenes.[57] The ELD by itself also does not provide for mandatory financial guarantee. It merely requests Member States to 'take measures to encourage the development of financial security instruments and markets.'[58] This solution is the result of deliberate policy[59] and falls in line with the CCS Directive's approach if it is understood not to require security.

While the inclusion of ELD liability is uncertain, Member States are free to provide for it.[60] For example, in England under para 7(1)(a) with (5)(b) in Schedule 2 of the Storage of Carbon Dioxide (Licensing etc) Regulations 2010[61] the financial security must cover costs arising 'under legislation implementing Articles 5(1) and 6(1) of the Environmental Liability Directive'.[62, 63] The financial contribution too has to cover ELD expenses. According to reg 10(1) of the Storage of Carbon Dioxide (Termination of Licences) Regulations 2011[64] the financial contribution has to be sufficient to cover the expected post-transfer costs. Regulation 3(3) of the same instrument defines post-transfer costs as 'the costs for which the authority will be liable as a result of the transfer of obligations and liabilities to the authority pursuant to regulations 14 and 15'. Regulation 14(d) prescribes expressly the transfer of 'preventive and remedial action under legislation implementing Articles 5(1) and 6(1) of Directive 2004/35/EC'. Unlike in England, in France the implementation does not refer to ELD liability in relation to the financial security and contribution.[65]

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56 Guidance Document 4 (n 12) 42-43.
57 Article 17, paras 4, 5.
58 Article 14, para 1; ELD.
59 Commission of the European Union Report of 12 October 2010 under Article 14(2) of Directive 2004/35/CE on the Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage, COM(2010) 581, at 4.2.
60 Also see: C Armeni, Case studies on the implementation of Directive 2009/31/EC on the geological storage of carbon dioxide, UCL Carbon Capture Legal Programme, November 2011.
61 Storage of Carbon Dioxide (Licensing etc) Regulations 2010/2221.
62 Ibid, reg 12(4)(e).
63 This is the effect of Schedule 2, para 7(5)(b) pointing to reg 12(6) pointing to paras (4) and (5) of the same provision.
64 Storage of Carbon Dioxide (Termination of Licences) Regulations 2011/1483.
65 See: art R516 – 2, IV, 4°, b) and art L229 – 47, I, d); Code de l'environnement.

The practical relevance of this discussion is that if ELD liability does not come compulsorily under art 19, Member States may require a smaller financial security from CCS operators, provided that their legislation allows this. This could be another form of shouldering some of the risk that would fall on the operator. Apart from the small likelihood of leakage, the risk for the State would be moderated by the fact that the operator must take into account the proximity of valuable natural resources as part of the application for the storage permit (art 7, para 9 and art 1(j), Annex I) and it must conduct an environmental impact assessment.[66] Where competent authorities require a contribution for potential ELD liability, it should be kept in mind that art 1.3.3 of Annex II enables the competent authority to decide that no further remedial measures are necessary if

> there is no longer any significant risk of adversely affecting human health, water or protected species and natural habitats[;] and the cost of the remedial measures that should be taken … would be disproportionate to the … benefits …

9 Transfer of responsibility after site closure by the competent authority

The CCS Directive indicates that the transfer of responsibility will not take place before at least 20 years have passed from closure.[67] However, earlier transfer may be possible where the competent authority is satisfied regarding the complete and permanent containment of the carbon dioxide.[68] Bergsten points out that no minimum time is specified to pass before the transfer of responsibility in case it is the competent authority who closes the storage site after the withdrawal of the storage permit.[69] Bergsten considers that this is so because in this case the competent authority also performs the duties of the operator and therefore the competent authority decides when it wants to transfer the responsibility — when the risk of CO_2 leakage is

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66 As storage sites come under the consolidated and amended Environmental Impact Assessment Directive: Directive 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, [2012] OJ L26/1 as amended by Directive 2014/52/EU of 16 April 2014 amending Directive 2011/92/EU, [2014] OJ L124/1.

67 Article 18, para 1(b); CCS Dir.

68 Ibid.

69 See art 11 para 3 and art 17 para 1(c).

as low as possible. In other words, the competent authority would prescribe a minimum period for itself.

However, in this paper's view even in this case the minimum period and the before-transfer criteria are relevant to the operator and the financial security providers. Even though, following art 17, para 4 the management of the storage site is with the competent authority after the closure, the financial responsibility remains with the operator and the financial security because the competent authority shall recover its costs under art 17, para 5 until the transfer of responsibility takes place under art 19, para 3(b)(ii). It would be unjustified to keep the operator and the providers of the financial security in uncertainty as to how long their liability lasts. In order to understand the lack of minimum period in this case, it must be seen first in what circumstances the operator may opt for withdrawing the storage permit and close the storage site. Article 11, para 3 lists these cases: leakages or significant irregularities, non-compliance with permit conditions, risk of leakages or significant irregularities, failure of the operator to meet permit conditions, necessity on the basis of the latest scientific findings and technological progress.[70] Even in these concern-raising cases the withdrawal of the storage permit is to take place as 'last resort' and even then the competent authority does not have to close the storage site as a rule but may issue a new storage permit (assuming the problem is rectified). It seems to follow that where the competent authority closes the storage site it is in response to an especially grave concern. By not providing for a minimum period it seems that the competent authority is given extra time to evaluate the circumstances, the safety of the storage site and claim against the operator or the financial security if necessary. The possibility of an art 17, para 1(c) closure may make the financial security more expensive. This may be balanced by defining in as much detail as possible at the permitting stage when the competent authority would resort to this form of closure.

[70] Indent (e), 'five years after issuing the permit and every 10 years thereafter' is not mentioned above because it is understood to be included in the para only for the purposes of reviewing and updating the storage permit.

10 Transfer of responsibility and insolvency

Another question Bergsten asked was whether the financial security can be turned into the financial contribution in case the operator becomes insolvent after site closure by the competent authority. Bergsten considered that this was so because art 19, para 3(b)(ii) states that if the competent authority closes the storage site, the operator must maintain the financial security until the requirements in art 18, para 8 are met and a financial contribution under art 20 is made. Bergsten assumed that an insolvent operator cannot provide the financial contribution and therefore the financial security must turn into the financial contribution for liability to be transferred.

It is considered here that art 19, para 3(b)(ii) is not about the case of an insolvent operator. An insolvent operator cannot be expected to maintain financial security. More generally, an insolvent operator cannot be expected to bear liability. Indeed, insolvency is one of the reasons for which the financial security has to be set up. It shields both the operator from large costs and the competent authority from the financial difficulties or insolvency of the operator. The operator ceases to be liable by the fact that it is insolvent (there is no transfer of responsibility from the operator as such) and the financial security steps in to cover the operator's obligations. Considering that part of the financial security is for contingencies and that it should cover the financial contribution in particular,[71] it would be inappropriate to pay it out as one sum to the competent authority on closure of the storage site. Rather, once the competent authority closed the storage site and it is satisfied about the containment, it should release the financial security (minus the costs it incurred for monitoring, closure etc) and claim its part allocated to the financial contribution. The practical difficulty arising in this scenario is that Guidance Document 4 requires the financial contribution to be part of the financial security from the closure period onwards which may be too late in an insolvency case. Member States would be advised to require the financial contribution to be part of the financial security from an earlier stage.

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[71] Guidance Document 4 (n 12) 8-9.

11 Conclusions

Although action in the EU for the introduction of CCS has begun more than eight years ago, the progress to date has been modest. Apart from the weak business case, stakeholders are concerned about the liability that may attach. Regarding this latter point, the review of the CCS Directive revealed that more Member State action is expected for CCS to develop in Europe. Instead of waiting for new rules, another approach is necessary. Member States need to devise a liability policy which does not stifle investment and which still holds the operator responsible for at least most of the contingencies that may occur. The ROAD project brings valuable lessons about how this balance may be achieved. Close co-operation with the authorities and tailor-made agreements are essential. Some terms of the CCS Directive are easier to resolve than others. As this paper intended to show, most issues arising from definitions can be overcome. Regarding the financial terms of the Directive, commercially practicable solutions need to be sought based on what is appropriate for the specific project.