



# Note 7

Barriers to  
transport and  
storage of CO<sub>2</sub>  
within the  
European Union



CNCA



BELLONA

# Barriers to transport and storage of CO<sub>2</sub> within the European Union

## 1. Summary

The purpose of this note is to enable cities to ascertain whether it is possible to transport and store CO<sub>2</sub> across national borders, and if not, what should be changed. This note addresses relevant national and international regulations and legislations that deal with issues related to cross-border transport and storage of CO<sub>2</sub> in Europe.

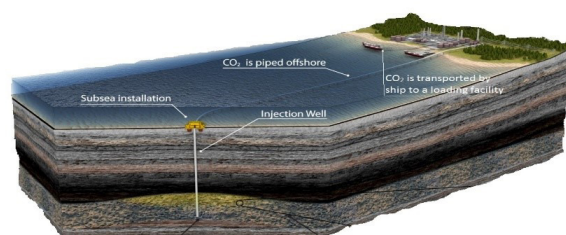
Each part of the CCS value chain (i.e. capture plant operator, transport operator and storage operator) transfers its ETS obligations (Directive 2003/87/EC) to the next part of the CCS value chain. Any leakages are assumed easily identified with proper monitoring. According to the polluter pays principle (Directive 2003/87/EC), each part of the CCS chain is liable to surrender allowances for the emissions occurring under their activity. The facility operating in the Member State (MS) where leakage occurs, would therefore be liable to surrender allowances of that State.

CO<sub>2</sub> capture for industrial use (CCU) is not eligible for Emissions Unit Allowance (EUA) exceptions as the CO<sub>2</sub> is not removed from the carbon cycle. So any plant that cleanses its flue gas for CO<sub>2</sub>, but later forwards that CO<sub>2</sub> for further use (CCU) in e.g. greenhouses, would have to purchase emission allowances for the emissions they capture.

Until recently there had been some uncertainty regarding the legality of cross-border CO<sub>2</sub> transport in the so-called London Convention<sup>1</sup> and Protocol. However, the London Protocol Parties at their annual meeting (LC41/LP14) in October 2019 approved a Resolution for Provisional Application of the 2009 CCS Export Amendment. This Provisional Application allows countries to agree to export and receive CO<sub>2</sub> for offshore geological storage.

Liability for damage to the local environment and the climate, resulting from any failure of permanent containment of CO<sub>2</sub> is covered in the CCS Directive (2009/31/EC). Liability for environmental damage such as damage to protected species and natural habitats, water and land is regulated by the Liability directive (2004/35/EC). Liability for climate damage as a result of leakages is covered by the ETS directive (2003/87/EC). Consequences such as human fatalities/injuries<sup>2</sup>, damage to infrastructure/facilities and/or disturbance of other commercial activity etc.

should be covered by the plans for development and operation of the CCS infrastructure. Incurred costs due to repairs or time-delays should also be covered by the plans and contracts for development and operation on a project basis by contracts. Liability for climate damage as a result of leakage is covered in Note 8 (which deals with the ETS Directive in detail), whilst the first two liabilities are covered in this document.



Figur 1: The figure shows the part of the CCS value chain covered by this document (modified from Gassnova and Bellona). In the figure captured CO<sub>2</sub> has been liquefied and transported by ship to a CO<sub>2</sub> receiving terminal. The liquefied CO<sub>2</sub> is then piped from the terminal via an offshore pipeline to a subsea injection well.

## 2. Introduction

There are no technical barriers to developing CO<sub>2</sub> transport and storage infrastructure. Apathy towards CCS in relation to renewables and suspicion of the motives of private sector operators may prove to be bigger barriers than concerns over technological risks.

The main barrier for development of CO<sub>2</sub> transport and storage infrastructure is inaction. Due to a lack of business models and a functioning market, developing CO<sub>2</sub> transport and storage infrastructure is not yet a commercial activity – thus there is no short-term incentive for action. This barrier will be addressed further in Notes 9a and 9b (which give an overview of financial instruments for CCS). Given the interconnected nature of the CO<sub>2</sub> capture, transport and storage value chain – with different owners and operators of the infrastructure, governments can decrease counter party risks and address structural market failures. Exactly how local governments and cities can contribute is addressed in Note 10.

This note discusses stipulated legal and practical barriers in relation to local governments, and in particular local governments in the five cities Amsterdam, Helsinki, Oslo,

<sup>1</sup> Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter

<sup>2</sup>For human fatalities/injuries elevated CO<sub>2</sub> concentrations (1-3% air by volume) cause no physical damage, but lead to rapid breathing, headaches, and tiredness. Above 3% incomplete gas exchange in the lungs causes CO<sub>2</sub> concentrations in the blood to increase and hence alter the pH of the blood. This condition is called hypercapnia and leads to brain malfunction, loss of consciousness and death at concentrations above 5-10% (Roberts et al. 2011). According to NIOSH and OSHA the limit for occupational exposure is 0,5%. IDLH (Immediate Dangerous to Life and Health) for CO<sub>2</sub> is 4%. At this concentration, if the exposure lasts for more than 30 minutes, it is considered that individuals will not be able to escape from death or permanent injury by their own.

Copenhagen and Stockholm. The note starts by addressing regulations and legislations that cover cross-border transport and storage of CO<sub>2</sub>, and culminates in a discussion of potential barriers for transporting and storing CO<sub>2</sub> from the five cities.

### 3. Current legal regimes for CO<sub>2</sub> transport and storage activities in the EU

- EU ETS Directive (2003/87/EC) & its Monitoring and Reporting Guidelines (2010/345/EU)
- Liability Directive (2004/35/EC)
- CCS Directive (2009/31/EC)
- London Protocol
- OSPAR convention

#### 3.1 EU ETS Directive (2003/87/EC) & its Monitoring and Reporting Guidelines (2010/345/EU)

CCS activities under the European Union Emission Trading System (EU ETS) is covered in note 8. A crucial element of the ETS Directive<sup>3</sup> is that it incentivizes CCS by counting the stored CO<sub>2</sub> as an emission reduction under the ETS “... allowances will not need to be surrendered for CO<sub>2</sub> emissions which are permanently stored” (recital 10 of 2003/87/EC 2017 amendment & recital 14 of 2018/410)<sup>4</sup>. But so far the price of EU emission unit allowances (EUAs) has failed to provide a decisive incentive for investment decisions to build CCS infrastructure.

The different parts of the CCS value chain are included in the Monitoring and Reporting Guidelines under the ETS Directive (as revised by Commission Decision 2010/345/EU). Each party transfers its ETS obligations to the next part of the CCS value chain – capture plant operator to transport infrastructure operator to storage operator.

The inclusion of CO<sub>2</sub> transport infrastructure<sup>5</sup> and storage sites in Directive 2003/87/EC requires the surrender of emissions trading allowances for any leaked emissions from the operations. Any leakage points in pipelines, ships or at storage sites (intermediate or permanent) are assumed to be easily identified with proper monitoring. As a rule of thumb, the facility operating in the State where leakage occurs would be liable to surrender allowances to that State. But on a project to project basis, clear rules should be provided in order to identify to which State a facility would have to surrender allowances in case of leakage along the CCS value chain.

CO<sub>2</sub> capture for industrial use (CCU) is not eligible for EUA exceptions as the CO<sub>2</sub> is not removed from the carbon cycle<sup>6</sup>. This means that any plant that cleanses its flue gas for CO<sub>2</sub>, but later forward that CO<sub>2</sub> for further use (CCU) in e.g. greenhouses, would have to purchase emission allowances for the emissions they capture.

#### 3.1.1 A short explanation to why there is a discussion of ship and truck versus pipeline transport of CO<sub>2</sub>

Art. 49 of the Commission Implementing Regulation (EU) 2018/2066 states that when a facility reports its greenhouse gas emissions (GHGs) it should subtract the emissions which are transferred out of the facility to any of the following: “i. a capture installation for the purpose of transport and long-term geological storage in a storage site permitted under Directive 2009/31/EC; ii. a transport network with the purpose of long-term geological storage in a storage site permitted under Directive 2009/31/EC; iii. a storage site permitted under Directive 2009/31/EC for the purpose of long-term geological storage; (b) transferred out of the installation and used to produce precipitated calcium carbonate, in which the used CO<sub>2</sub> is chemically bound” (Art. 49 2018/2006).

According to Art. 3 (52) “CO<sub>2</sub> transport” means the transport of CO<sub>2</sub> by pipelines for geological storage in a storage site permitted under Directive 2009/31/EC” (Art. 3 2018/2006), and thus alternative i. and ii. which refers to “transport” and “transport network” would imply transport by pipeline<sup>7</sup>.

Alternative iii., where the CO<sub>2</sub> is transferred out of the facility and has arrived at the storage site permitted under Directive 2009/31/EC (without specific mention of CO<sub>2</sub> transport), opens for an interpretation where the capture plant operator can subtract the emissions. In this scenario, obligations are not moved along the CCS value chain, but sits with the capture plant operator until it arrives at the storage site. This interpretation fits well with the wording of Annex IV section 21 A, regarding the scope of the greenhouse gas emissions permit and the associated monitoring plan<sup>8</sup>.

In the scenarios stipulated by alternative i. and ii. the capture plant can subtract its emissions much sooner and will not be responsible for submitting allowances for any leakage during transport. The underlying reason for this is that the pipeline transport network, as opposed to ship or truck transport of CO<sub>2</sub>, is in itself an ETS-activity (Annex 1).

<sup>3</sup> Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/E

<sup>4</sup> According to Article 12 item 3a of Directive 2003/87/EC, an obligation to surrender allowances shall not arise in respect of emissions verified as captured and transported for permanent storage to a facility for which a permit in accordance with Directive 2009/31/EC (the CCS Directive) is in force.

<sup>5</sup> See section 3.1.1 for a further discussion of what’s defined as infrastructure for “CO<sub>2</sub> transport” under the ETS

<sup>6</sup> The annual atmospheric carbon net increase is due to the ever renewed addition of fossil CO<sub>2</sub> (mainly from extracted and burned coal, oil, gas and carbonate)

<sup>7</sup> Art. 3 (22) of the CCS-directive has a similar definition: “‘transport network’ means the network of pipelines, including associated booster stations, for the transport of CO<sub>2</sub> to the storage site”

<sup>8</sup> Note also that an “emission” according to Art. 3 b) of the ETS directive is a “release of greenhouse gases into the atmosphere”. So transfer of CO<sub>2</sub> to a ship or a truck from a capture plant can only be counted as an emission in the case of leakage (since the CO<sub>2</sub> will be transferred to a pipeline transport network or a storage site).

The operator of the pipeline network would therefore be obliged to surrender allowances for emissions of CO<sub>2</sub> from the network. Ships and trucks are exempted from the leakage part of the obligation. And, as mentioned, the obligation to surrender allowances for leakages of CO<sub>2</sub> from ship or truck transport would therefore – in theory – most likely remain with the capture plant unless the liability is transferred to the transport operator in project-by-project agreements<sup>9</sup>.

### 3.1.2 Intermediate storage

Along the CCS value chain CO<sub>2</sub> need to be temporarily stored. Such a need could incur due to multiple causes – of which some could be logistic and operational (waiting, down-time, maintenance, time-delays etc.), or maybe due to capacity requirements at the injection sites (a certain injection well might work more optimally at a certain injection rate).

Such temporary storage locations should be considered as licensed facilities under the EU ETS scheme in the sense that any leakage arising from them would require surrendering of EUAs. As long as the CO<sub>2</sub> is temporarily stored, the CO<sub>2</sub> should not be considered as stored and the CO<sub>2</sub> producer should not be released from his obligation to surrender allowances. The operator of the temporary storage will be liable for surrendering EUAs equivalent to the net flow into the tank in the course of each reporting period under the ETS Directive. Annex IV of the MRR, section 21 A (scope) states: “CO<sub>2</sub> capture shall be performed either by a dedicated installation receiving CO<sub>2</sub> by transfer from one or more other installations, or by the same installation carrying out the activities producing the captured CO<sub>2</sub> under the same greenhouse gas emissions permit. All parts of the installation related to CO<sub>2</sub> capture, **intermediate storage**, transfer to a CO<sub>2</sub> transport network or to a site for geological storage of CO<sub>2</sub> greenhouse gas emissions shall be included in the greenhouse gas emissions permit and accounted for in the associated monitoring plan.”

### 3.2 CCS Directive (2009/31/EC) and its guidance documents

CO<sub>2</sub> storage is regulated through Directive 2009/31/EC<sup>10</sup> (hereafter called “the CCS Directive”) and the associated four guidance documents. In order for CO<sub>2</sub> injection to benefit from not having to surrender EUAs, the CO<sub>2</sub> injection must comply with the CCS Directive.

According to the European Commission, “The CCS Directive aims to ensure that there is no significant risk of leakage of CO<sub>2</sub> or damage to health or the environment, and to prevent any adverse effects on the security of the

transport network or storage sites” (EC, 2017: 2).

The CCS Directive focuses mainly on storage issues. It provides a legal framework for the management of environmental and health risks related to CO<sub>2</sub> storage, including requirements on permitting, composition of the CO<sub>2</sub> stream, monitoring, reporting, inspections, corrective measures, closure and post-closure obligations, transfer of responsibility to the State and Financial Security (FS). Only geological formations that, under the proposed conditions of use, demonstrate no significant risk of leakage can be used for CO<sub>2</sub> storage (Art 4 of Directive 2009/31).

Although the CCS Directive aims to prevent any adverse effects on the security of the transport network, CO<sub>2</sub> emissions from shipping are not yet covered by the CCS Directive.

The detailed implementation of the CCS Directive has been left to the EU Member States, and relies heavily on national competent authorities. The CCS Directive explicitly states that “Liabilities other than those covered by this Directive, Directive 2003/87/EC and Directive 2004/35/EC, in particular concerning the injection phase, the closure of the storage site and the period after transfer of legal obligations to the competent authority, should be dealt with at national level” (Art 34 of Directive 2009/31).

### 3.3 The Liability Directive (2004/35/EC)

The potential liability of operators involved in the CCS chain cannot only be limited to their compliance with the EU ETS scheme (liability for climate change). The operator is also liable for damage to the local environment under the Environmental Liability Directive 2004/35/EC<sup>11</sup> (hereafter called “the Liability Directive” or ELD). But ELD only applies in narrow circumstances and provides that liability is statute barred after 30 years.

#### 3.3.1 Local environmental consequences

- If CO<sub>2</sub> leaks to seawater some of the CO<sub>2</sub> will dissolve and decrease the pH-value (Figure 5 shows the relation between dissolved CO<sub>2</sub> and pH). pH is rapidly decreased at an increased CO<sub>2</sub> concentration from a concentration of 0.01 % (corresponding with pH 8 which represents sea water). A study by PICHTR (2001) concludes that a reduction of pH > 0,2 units can lead to increased mortality for marine species at a long-lasting exposure.

- Potential leak scenarios through the cap rock/overburden areas are distributed over a large area, but in the case of a given leakage it will affect a constrained area. For large leak rates a local area around the leak zone (fault/crack) near the sea bottom could experience a non-negligible

<sup>9</sup> Unless the plant can convincingly argue for alternative i. of Art. 49 where transfer to a capture installation for the purpose of transport and long-term geological storage is sufficient. In this case, any leaked CO<sub>2</sub> from ship or truck transport would be “in limbo” and unaccounted for.

<sup>10</sup> Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006

<sup>11</sup> Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.

reduction of the pH-value of the sea. Mobile creatures near any leaks will most likely attempt to move away to a place not affected by the leak.

- During a blow-out CO<sub>2</sub> is believed to be concentrated in a narrow plume where most CO<sub>2</sub> reach the sea-level as gas. In such a scenario some of the CO<sub>2</sub> in the subsea plume will be dissolved in the sea. Since seawater with dissolved CO<sub>2</sub> has a higher density than ordinary seawater it will most probably spread out due to gravity spreading given sufficient concentrations of dissolved CO<sub>2</sub>. Locally dissolved CO<sub>2</sub> can form a local zone in the water column around the plume and close to the sea bottom with a non-negligible reduction of seawater pH-values. Generally well-control is re-gained within 2 months and thus the duration of CO<sub>2</sub>-exposure is limited (Tjetland et. al. 2012).

Global environmental consequences of a potential leak are covered by the ETS Directive. However, it should be noted that according to ELD Directive Art. 4 §1, compensation could not be claimed for loss resulting from CO<sub>2</sub> storage failure due to “natural phenomenon of exceptional, inevitable and irresistible character” such as astronomical impact, volcanism and earthquakes. But in cases where documentation demonstrating that leaks and other consequences are caused by non-compliance with the facilities regulations, design criteria or the “activities of individual operators” compensation can be claimed (ELD Directive 2004/35/EC Art. 4 §5). The operator can also be liable under national legislation for aspects not covered by the ELD. In practice, this could conceivably mean e.g. the decontamination of land and water (of toxic substances due to chemical reactions triggered by the CO<sub>2</sub>) in case of leakage of CO<sub>2</sub>.

### 3.4 The London Protocol

Ship transport is international marine environmental conventions such as the OSPAR Convention (for the North-East Atlantic) and London Protocol (global). All the five cities are bound by the international OSPAR Convention and the London Protocol. The previous interpretation of Art. 6 of the London Protocol was that transboundary movement of CO<sub>2</sub> for permanent storage is prohibited. The London Protocol Parties at their annual meeting (LC41/LP14) in October 2019 approved a Resolution for Provisional Application of the 2009 CCS Export Amendment. This Provisional Application allows countries to agree to export and receive CO<sub>2</sub> for offshore

geological storage.

### 3.5 OSPAR convention

In 2007 the OSPAR Commission amended the Annexes of the Convention to allow the storage of carbon dioxide in geological formations under the seabed following OSPAR's 2006 report on ocean acidification. Contracting parties are mainly countries on the western coast of Europe. All five cities in the CNCA project are contracting parties in the OSPAR on the national level.

### 4.0 Activities relevant for the five cities

The most mature storage locations in Europe are found offshore, in the North Sea. The relevant parts of the North Sea are under the jurisdiction of United Kingdom, the Netherlands, Norway and Denmark. On the Norwegian shelf two wells are currently injecting liquid CO<sub>2</sub> and a third well (at a third location) was being drilled at the time of writing (December 2019). Storage locations further away (from the five above-mentioned cities in the CNCA project) or in the Baltic Sea, are currently less mature in terms of technical screening and preparations. This is why this report only covers legal regulations relevant for storage in the North Sea and transport to the North Sea from the five cities (Amsterdam, Oslo, Helsinki, Copenhagen and Stockholm).

The Netherlands, Norway and UK permits national CO<sub>2</sub> storage, whilst Denmark allows it with some temporary restrictions. In Finland CO<sub>2</sub> storage is prohibited, except for research and development, due to their geological conditions. Sweden was somewhat late in implementing the CCS Directive, but updated its legislation in 2014 and permitted offshore CO<sub>2</sub> storage (Shogenova A. et al. 2014: 6663).

In 2019 a new exploitation permit for CO<sub>2</sub> storage was granted in Norway (two other licenses have permits to store CO<sub>2</sub> elsewhere). Both UK and the Netherlands have granted storage permits to projects that were later cancelled (the Peterhead CCS project and the ROAD project). But a new application is expected to be submitted in the Netherlands as part of the PORTHOS and/or ATHOS project (which are so-called EU Projects of Common Interest). No applications have been submitted in Denmark at the time of writing.

There are two active CCS regional networks working to develop common, transboundary solutions for the trans-

<sup>12</sup>Article 6 reads: “Contracting Parties shall not allow the export of wastes or other matter to other countries for dumping or incineration at sea”.

<sup>13</sup> <https://e24.no/energi/regjeringen-vil-bla-opp-for-co-broenn-i-nordsjoeen/24600779>

<sup>14</sup> The relevant regulation is called “Regulations relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf” (FOR-2014-12-05-1517). Nevertheless, it should be noted that CO<sub>2</sub> storage operations as part of petroleum activities are regulated through the “Act relating to petroleum activities” (FOR-1997-06-27-653), “Act relating to scientific research and exploration for and exploitation of subsea natural resources other than petroleum resources” (1963 no. 12) and the Pollution Control Act (1981 No.6). Only storage sites that store CO<sub>2</sub> from non-petroleum-activities operate under the new “Regulations relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf”.

<sup>15</sup> Public and private bodies working together to develop common principles for managing and regulating the transport, injection and permanent storage of CO<sub>2</sub> in the North Sea sub-seabed.

<sup>16</sup> <http://bcforum.net/index.php>

sport and geological storage of CO<sub>2</sub>. The UK, the Netherlands, Norway, Germany and Belgium have joined in the North Sea Basin Task Force. CCS actors from Estonia, Germany, Finland, Norway and Sweden have come together in the Baltic Sea Region CCS network. These networks work to ensure access to CCS infrastructure for operators in Member States where there is no possibility of geological CO<sub>2</sub> storage.

For Amsterdam, a national legislative amendment might also be required before ship transport of CO<sub>2</sub> from Dutch harbours can be realized. As the one of the deliverables (on the regulation of liability and safety in ship transport of CO<sub>2</sub>) from the CATO research program points out the RVGZ (Regeling Vervoer Gevaarlijke Stoffen met Zeeschepen) should be amended to make the ship transport of CO<sub>2</sub> between Dutch harbours and the sea unequivocally legal (CATO 2013: 3). And if the CO<sub>2</sub> comes from the inland regions, it is an issue that liquefied CO<sub>2</sub> is currently not approved as a cargo on Rhine barges as per ADN regulations. UN1058 (Liquefied gases, nonflammable) is not in the cargo list, and shall have to be requested to the ADN committee through one of the member countries. But as CATO (2013: 48) states “this seems likely to be an unintentional barrier as CO<sub>2</sub> is not a highly toxic gas. Be that as it may, the Minister of Infrastructure and Environment has the means to derogate from this prohibition, meaning that the legal barrier is expected to be of limited interference to the future large scale rolling out of ship transport of liquefied CO<sub>2</sub>”. However, CATO would welcome an amendment of the law as it stands today in order to prevent unnecessary procedures and paperwork in the future.

## 5.0 Summary of barriers to transport and storage within the EU

### 5.1 Lack of incentives or a guarantee of income

Private and commercial storage operators need a guarantee of income before they can invest in facilities for CO<sub>2</sub> injection. The capital outlays for drilling wells and installing necessary infrastructure such as pipelines, sub-sea facilities etc. are significant must be realized some years before injection starts. This implies large expenses upfront, which in turn, increases the storage project's need for certainty. Such a need for certainty does not only apply to storage projects, but also transport and capture plant operators need to believe in a business model in order to perform feasibility and routing studies.

The Netherlands, Norway and the UK have pledged significant funding for specific demonstration plants, but no EU Member States have adopted a general incentive scheme targeted at CCS. Additional incentives are therefore needed. One way of lowering the CO<sub>2</sub> price volatility

is to stabilize a carbon price floor by using a combination of EU emission unit allowances (EUAs) and a carbon tax (Abadie and Chamorro, 2008). An example where one such incentive is being implemented<sup>17</sup> is the Dutch “Klimaattoekkoord”, where the ETS is supplemented with a carbon tax (Dutch Government 2019). Such incentives are further covered by Note 9B.

### 5.2 Access rights to CCS infrastructure

The CCS Directive does not specify who is entitled to access transport and storage networks (the directive does not state who is a user or potential user). This is left to Member States to decide. Indeed, MSs “...shall take the necessary measures to ensure that potential users are able to obtain access to transport networks and to storage sites for the purpose of geological storage of the produced and captured CO<sub>2</sub> in accordance with paragraphs 2, 3 and 4” (Art. 21 2009/31/EC).

Potential users could thus include all the entities involved in the CCS chain, from the CO<sub>2</sub> producer through the transport operator to the storage operator.

Art. 21 of the CCS Directive lists the valid derogations when designing the regulatory regime for Third Party Access (TPA). Birkeland et al. (2010) find that an operator could refuse TPA based on:

- Technical reasons. If there is an incompatibility of technical specifications that cannot be reasonably overcome. Denial due to technical reasons (e.g. pressure, temperature, H<sub>2</sub>O content or other CO<sub>2</sub> stream compositions that are not compatible with the transport network or the specification for storage) raises the question of what is considered to be “reasonable to overcome”. It is however more likely that if it requires large investments to remediate, it would not be reasonable. For new activities such as pipeline transport of industrial CO<sub>2</sub>, this may be difficult to judge and underlines the importance of flexible but clear European standards.

- Lack of capacity. A facility operator is only obliged to provide access to the extent of available capacity. Since access may be denied if capacity has run out, the way in which the capacity is allocated is therefore important. The regulated tariffs will be crucial to determine whether there will be a real risk of under-capacity. For the near future, however, this is not an issue given the lack of CO<sub>2</sub> for storage projects. If an operator refuses third parties access on the grounds of lack of capacity or a lack of connection, it is up to each MS to take the measures necessary to ensure that the operator makes any enhancements provided a prospective customer is willing to pay for them. Additional storage capacity can in most cases be achieved by drilling new injection wells and connecting

<sup>17</sup> The cabinet has submitted the plan to the Parliament for their approval

them to the transport network. The situation for expanding capacity for a transport network may be more challenging, since pipelines are normally dimensioned for a specific capacity and operating conditions, i.e. with little spare capacity, and with limited 'turn down', i.e. ability to operate at low flow rates. However, transport by ship may present flexibility by adding new ships as needed and re-optimizing routing and logistics as new capture facilities come into operation.

- **Need of owner/operators/existing users:** Whether it is necessary to respect a storage or transport operator's (or the interests of other users of the CO<sub>2</sub> storage or transport network and/or relevant processing or handling facilities who may be affected) duly substantiated and reasonable needs. This is strongly dependent on allocation of capacity (see previous point). If the owner has the operative responsibility and allocates capacity to themselves or to connected companies in preference to other potential users, it could be considered as discrimination.

- **Climate obligations:** Whether access would affect the national CO<sub>2</sub> reduction obligations. The CCS Directive Art. 21 states that it is up to the MS to decide the proportion of CO<sub>2</sub> reductions that they intend to meet through CCS. If a MS has already met its reduction obligations through CCS, the Directive suggests that third parties will not have any right to access under fair and open conditions. It may however be challenging for MSs to assess when this target is achieved as facilities covered by the EU ETS system are not subject to a 'cap' in emissions (their only obligation being to surrender allowances). Therefore MSs are limited to verify that actual emissions match surrendered EUAs and other emission allowances. Hence it is difficult to give this criterion any significance.

Conditions for access should be set as to encourage widespread CCS deployment, e.g. by weighing the need to provide incentives for first movers who build infrastructure with the need to reduce transport and storage prices.

## 6.0 Changes required to enable multi-national transport and storage within EU

The political momentum for CCS in the EU has been growing, and CCS is explicitly acknowledged as a necessary climate measure by both the Juncker Commission (2014-2019) and by the new von der Leyen Commission. One can therefore argue that possible uncertainties regarding interpretation of legislation will be resolved. Below are some aspects that might arise as CO<sub>2</sub> transport projects become a reality.

The ETS and CCS Directives allow for an interpretation where CO<sub>2</sub> leakages from ships or trucks transporting liquefied CO<sub>2</sub> for permanent storage might not be accountable. This lack of clarity could deteriorate the integrity of the CCS value chain and could, in principle, imply that only CO<sub>2</sub> capture plants which are physically

connected to storage sites (via pipelines) are eligible for EUA exceptions. But as the basic rule in Art. 12 item 3a of the ETS Directive is that there is no obligation to surrender allowances in respect of emissions verified as captured and transported for permanent storage to a facility with a valid permit, different transportation choices should not affect the right to subtract emissions. Furthermore, an exclusion of other forms of transport than by pipeline could severely hamper the development of CCS in the EU, contrary to the objectives of the ETS.

The Norwegian government has suggested, in a letter to DG CLIMA, to account the CO<sub>2</sub> at the ship terminal instead of at the plant. This solution means that the CO<sub>2</sub> would be physically connected to the CO<sub>2</sub> storage (via a pipeline from the terminal – see Figure 1). The Norwegian government provides convincing arguments against an interpretation where CO<sub>2</sub> transport by ships or trucks for permanent storage is not covered by the ETS Directive: "An interpretation of MRR Article 49 whereby the right to subtract captured CO<sub>2</sub> is denied because the CO<sub>2</sub> is transferred to a ship or truck, regardless of whether or not the CO<sub>2</sub> is released into the atmosphere, would – as described above – neither be in line with the definition of "emission", nor with the basic rule in the ETS-directive 12 item 3a" (Norwegian government, 2019). Agreements between involved parties where the transport network operator pledge responsibility and accountability for any leakages occurring during transport, would ensure the integrity of the CCS value chain.

Different rules might be necessary to cover situations of leakage occurring in cross border pipelines and during ship transport. And clear rules should be provided in order to identify to which State a facility would have to surrender allowances in case of plausible scenarios of leakage in components of either the capture, transport or storage installations: As a rule of thumb, – the facility operating in the State where leakage occurs would be liable to surrender allowances to that State.

Transport of liquefied CO<sub>2</sub> by ship and truck within a CCS chain should be covered by the ETS Directive in order to maintain the integrity of the chain. In their "Klimaatakkoord" the Dutch Government specifically states that they will pursue adjustments of European legislation for CO<sub>2</sub> transport by ship and cross-border transportation of CO<sub>2</sub> (Dutch Government 2019: p. 108). As an immediate solution the European Commission can include this on a project by project basis, as mandated by the ETS Directive Art. 24a.

Lastly, in order to comply with the London Protocol, countries that send and receive CO<sub>2</sub> to/from other countries will need to make bilateral agreements. Countries with intentions of sending CO<sub>2</sub> out of the country should make sure their national government has or signs an agreement with the receiving country, unless this is already in place.

## References

- Abadie, L.M. and J.M. Chamorro. 2008. *European CO<sub>2</sub> prices and carbon capture investments*. Energy Economics, 30(6):2992–3015
- Birkeland, L., Tjetland, G., Hoff, E., Eickhoff, C., Domitrovic, D., Bernstone, D. and Pages. A. 2010. “Improving the Regulatory Framework, optimizing organization of the CCS value chain and financial incentives for CO<sub>2</sub>-EOR in Europe”, Available: <http://bellona.org/ccs/ccs-news-events/publications/article/improving-the-regulatory-framework-optimizing-organization-of-the-ccs-value-chain-and-financial-inc.html>
- CATO. 2013. *Regulation of liability and safety in ship transport of CO<sub>2</sub>*, Doc. Nr. CATO2-WP4.1-D11, URL: <https://www.co2-cato.org/publications/library1/regulation-of-liability-and-safety-in-ship-transport-of-co2>
- CATO. 2013.2. *Legal barriers to CCS in the North Sea*, CATO2-WP4.1-D07, URL: <https://www.co2-cato.org/publications/library1/legal-and-regulatory-barriers-to-ccs-projects-in-europe>
- Dixon, Tim. Positive Result on the London Protocol's CCS Export Amendment. <https://ieaghg.org/ccs-resources/blog/positive-result-on-the-london-protocol-s-ccs-export-amendment>
- Dutch Government. 2019. *Klimaatakkoord*. Den Haag 28 juni 2019. Available: <https://www.klimaatakkoord.nl/documenten/publicaties/2019/06/28/klimaatakkoord>
- Element Energy. 2010. “One North Sea: A study into North Sea cross-border CO<sub>2</sub> transport and storage”. Report for The Norwegian Ministry of Petroleum and Energy and The UK Foreign and Commonwealth Office on behalf of The North Sea Basin Task Force. Available at: [https://www.regjeringen.no/globalassets/upload/oed/onenortsea\\_fulldoc.pdf](https://www.regjeringen.no/globalassets/upload/oed/onenortsea_fulldoc.pdf)
- European Parliament. 2004. *Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage*. URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004L0035&from=EN>
- European Parliament. 2009. *Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006*, URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0031&from=EN>
- European Parliament. 2012. *Commission Regulation (EU) No 601/2012 of June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council*. URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012R0601&from=EN#d1e32-72-1>
- European Parliament. 2017. *Report from the Commission to the European Parliament and the Council on Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide*, URL: [https://ec.europa.eu/clima/sites/clima/files/docs/pages/com20017\\_37\\_ccs\\_directive\\_implementation\\_report\\_en.docx](https://ec.europa.eu/clima/sites/clima/files/docs/pages/com20017_37_ccs_directive_implementation_report_en.docx)



European Parliament. 2018. *Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814* URL:

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0410&from=EN>

Freiberg, K-B. 2019. *Opening speech at the Trondheim CCS Conference on June 18<sup>th</sup> 2019*. Available:

<https://www.regjeringen.no/no/aktuelt/tccs/id2655052/>

International Energy Agency (IEA). 2011. *Carbon capture and storage and the London Protocol – Options for enabling transboundary CO<sub>2</sub> transfer*, Working paper. Paris, France.

London Protocol. 2006. "1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 as amended in 2006", URL:

<http://www.imo.org/en/OurWork/Environment/LCLP/Documents/PROTOCOLAmended2006.pdf>

London Protocol. 2009. "Resolution LP.3(4) (Adopted on 30 October 2009) On the Amendment to Article 6 of the London Protocol, URL:

[http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/London-Convention-London-Protocol-\(LDC-LC-LP\)/Documents/LP.3\(4\).pdf](http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/London-Convention-London-Protocol-(LDC-LC-LP)/Documents/LP.3(4).pdf)

Norwegian government. 1963. *Act relating to scientific research and exploration for and exploitation of subsea natural resources other than petroleum resources*. 21 June 1963. URL:

<https://www.npd.no/en/regulations/regulations/scientific-research/>

Norwegian government. 1996. *Regulations to Act relating to petroleum activities*. Act 29 November 1996 no 72. EEA references: EEA Agreement Annex XX Chapter III No. 21 (Directive 2009/31/EC). URL:

<https://www.npd.no/en/regulations/regulations/petroleum-activities/>

Norwegian government. 2014. *Regulations relating to exploitation of subsea reservoirs on the continental shelf for storage of CO<sub>2</sub> and relating to transportation of CO<sub>2</sub> on the continental shelf*. 5 December 2014. EEA references: EEA Agreement Annex XX Chapter III No. 21 (Directive 2009/31/EC). URL:

<https://www.npd.no/en/regulations/regulations/exploitation-of-subsea-reservoirs-on-the-continental-shelf-for-storage-of-and-transportation-of-co/>

Norwegian government. 2019. "The Norwegian CCS demonstration project - request for legal clarifications related to the ETS directive and the MR-regulation". Letter from Norwegian Ministry of Climate and Environment) to DG CLIMA dated 7<sup>th</sup> of July 2019.

OSPAR. 2007. *OSPAR Convention*, URL: <https://www.ospar.org/convention/text>

PICHTER, 2001, *Environmental Assessment, Ocean Sequestration of CO<sub>2</sub> Field experiment*, Technical report December 2001

Shogenova, A., Piessens, K., Holloway, S., Bentham, M., Martínez, R., Flornes, K. M., Poulsen, N. E., Wójcicki, A., Sliupa, S., Kucharič, L, Dudu, A, Persoglia, S, Hladik, V., Saftic, B., Kvassnes, A., Shogenov, K., Ivask, J., Suárez, I., Sava, C., Sorin A. and Chikkatur A.. 2014. "Implementation of the EU CCS Directive in Europe: results and development in 2013", *Energy Procedia*, 63, 6662 – 6670

Tjetland, G., Erichsen E., Horntvedt L., Haaberg K., Rørvik K-L. and Høydalsvik H. 2012. "Liabilities associated with CO<sub>2</sub> storage – a technical review". Gassnova report.

On the Cover: Amager Bakke (Photo: Amager Resource Center/Ehrhorn/Hummerston)