Carbon Capture and Storage: A New Challenge for International Environmental Law

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I. Introduction

International environmental law owes much of its particular dynamics to scientific progress. New insights into the characteristics and interdependencies of environmental problems are constantly generated and technological and scientific progress continuously broaden the portfolio of response measures. The particular challenge for the international lawyer and policy-maker is to design flexible legal instruments which are able to adequately respond to and account for the continuous technological and scientific advancement. The demand for high flexibility has led to the evolvement of manifold flexibility mechanisms in environmental treaty regimes. This is often met through informal and formal regulatory activity within regimes and organizations that is akin to that of domestic administrations.

In the case at hand, the environmental problem of climate change is now well known, but its implications are not yet entirely understood. In particular the interdependencies of the issue with other areas of environmental protection such as the protection of biodiversity or the protection of marine living resources are now surfacing. The protection sought requires regulatory responses which transcend traditional boundaries of environmental regimes. As will be seen, this leads to the situation that the issue of climate change, in this case due to the ocean acidification deriving from increased levels of carbon dioxide in the atmosphere, now becomes a concern even for policy-makers within treaty regimes other than that of the UNFCCC, and necessitates new linkages between them. At the same time, the newly emerging technological possibilities such as carbon capture and storage (CCS) represent new options in the portfolio of tackling climate change. If they indeed represent a viable and promising avenue to address climate change, and if marine protection treaties stand in the way of such technology, then adaptation of marine protection treaties might be needed not necessarily to avoid conflicts with another treaty regime (UNFCCC), but because such action is needed to further the genuine aims of those treaties.

As the term already indicates, CCS is a technology that allows for the capturing of carbon dioxide from emissions of fossil fuel operated plants, such as coal or gas plants. Different storage options for such emissions exist, including geological storage and ocean storage, by which the carbon dioxide is directly injected into the water column or deposited at 3000 meters depth where it is denser than water and

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is expected to form "lakes" on the sea floor.[1] The potential of this new technology seems indeed enormous. Cost-effective CCS alone is estimated to have a reduction potential which could contribute up to 55 percent of the worldwide cumulative mitigation effort by 2100.[2]

So is this the new technology that the world desperately needed? Unfortunately, there exist important caveats. Firstly, the capture and compression of carbon dioxide requires a substantial amount of additional energy input, namely up to 40 percent per unit of energy output.[3] Secondly, storage remains problematic. Carbon dioxide may subsequently escape from the reservoirs into the ocean or the atmosphere, an effect that is technically referred to as physical leakage. As no storage option is consequently permanent, emissions are only temporally avoided. Among the different options, geological storage, for example in depleted oil fields under the North Sea, is being considered as an attractive storage option, because physical leakage is estimated to be very low.[4] In addition, experience already exists with the required technology due to the usage of enhanced oil recovery techniques by which oil is retrieved through the insertion of carbon dioxide. Related to potential physical leakage is the third obstacle. If there is physical leakage of carbon dioxide into the ocean, the effects on the marine environment could be devastating, depending on the speed of the leakage.[5] Overall, such effects are still not fully researched.

These limitations are serious enough to disqualify CCS as the sole solution. However, CCS in a relatively safe form, e.g. in geological formations under the ocean, may be considered as an important part of the portfolio of climate change mitigation measures. Although only a temporary and second-best solution, it could still contribute to bridging the gap between the fossil fuel age and an age of clean energy.

The further question arises whether CCS, as a viable option, is compatible with international law. Only in cases of conflicts between treaties or in cases of illegality of CCS with a treaty does the necessity arise to adapt the respective legal rules. I will therefore attempt a brief assessment of the general compatibility of CCS in sub-seabed geological formations with some relevant treaty regimes. The first part of this short article will then point to some issues of compatibility arising under the climate change regime (II.). In the second part, the legality of CCS under the seabed with regard to marine protection treaties is addressed in a manner that merely highlights the main legal problems rather than exhaustively discussing all

[1] Compare for the scientific background to the issue the extensive IPCC Special Report on Carbon Capture and Storage, Cambridge/New York 2005, cf. <http://www.ipcc.ch/pub/reports.htm>.

[2] IPCC Special Report (note 1), Summary for Policymakers, section 19.

[3] Ibid., section 4.

[4] See IPCC Special Report (note 1), Technical Summary, section 5 (estimating that up to 99 percent of the carbon dioxide first inserted may remain trapped in depleted oil fields for over 1000 years).

[5] Ray Purdy/Richard Macrory, Geological Carbon Sequestration: Critical Legal Issues, Tyndall Centre for Climate Change Research, Working Paper 45, January 2004, 4.

the legal and factual technicalities of this issue (III.).[6] To the extent that incompatibilities arise, possible avenues of treaty adaptation and coordination are identified. These flexible means give testimony to the ability of international environmental treaty law to quickly respond to new challenges, often in deviation from traditional forms of consent in international law.[7] Overall, the article is also intended to give an overview over some of the issues that are under discussion and are being addressed within the respective treaty regimes in response to the challenge.

II. Compatibility with the Climate Change Regime

1. Admissibility of CCS

The United Nations Framework Convention on Climate Change (FCCC)[8] was concluded with a view to stabilizing greenhouse gas emissions. It contains a general obligation to limit emissions.[9] The Kyoto Protocol to the FCCC,[10] which entered into force in 2005, provides for binding targets for developed countries, as included in Annex 1 of the Protocol.[11]

Neither the FCCC nor the Kyoto Protocol directly deal with CCS, and thus it has so far remained unclear whether CCS could be a means of fulfilling emission reduction obligations. Generally, the targets of the Kyoto Protocol can either be achieved by preventing emissions from entering the atmosphere at the source, or by removing them once they are emitted. While neither the FCCC nor the Kyoto Protocol specify the means of emission reduction at the source, the Kyoto Protocol limits the means for removing emitted greenhouse gases from the atmosphere to land-use and forestry projects.[12] If CCS were considered to be a sink, which is defined as "any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere"[13], the Kyoto Protocol would have to be amended. If CCS were considered to be an emission reduction at the source, no amendment would be necessary. At least the abovementioned danger of physical leakage and the impermanence of storage seem to

[6] See for a more detailed and extensive coverage of the issue Karen N. Scott, The Day After Tomorrow: Ocean CO2 Sequestration and the Future of Climate Change, Georgetown International Environmental Law Review 18 (2005), 57 et seq.

[7] See for this development with a particular focus on the role of the Conference of the Parties Jutta Brunnée, COPing With Consent: Law-Making Under Multilateral Environmental Agreements, Leiden Journal of International Law 15 (2002), 1 et seq.

[8] United Nations Framework Convention on Climate Change, 9 May 1992, 31 I.L.M. 849 (1992).

[9] Article 2 FCCC.

[10] Kyoto Protocol to the United Nations Framework Convention on Climate Change, 10 December 1997, UN Doc. FCCC/CP/1997/L.7/Add.1, 37 I.L.M. 22 (1998).

[11] Article 3, Kyoto Protocol.

[12] Article 3 (3) and (4), Kyoto Protocol.

[13] Article 1 (8), Kyoto Protocol.

support a qualification of CCS as a sink. On the other hand, CCS is a technology that effectively prevents carbon dioxide from reaching the atmosphere, and thus it avoids the captured emissions, even though only for a limited amount of time.[14] The general permissibility of CCS is underscored by the express requirement that Annex 1 Parties, i.e. developed states, should "implement policies and research, on the promotion, development and increased use of carbon dioxide sequestration technologies".[15] Physical leakage does not disqualify CCS as a climate mitigation measure if it is conducted in well-selected and managed geological storage sites by which – according to the IPCC – the vast majority of carbon dioxide could be retained for up to millions of years.[16]

Therefore, it seems to be safe to conclude that the Kyoto Protocol even in its present form does not prohibit CCS, but rather welcomes and requires efforts of Parties to use sequestration technologies such as CCS. The current text of the Kyoto Protocol supports the argument that CCS is one of the measures states may take to fulfill their obligations under the Framework Convention on Climate Change and the Kyoto Protocol. The issue of leakage and permanence however poses challenges for the accounting and reporting scheme under the climate change regime.

2. Implications for Greenhouse Gas Inventories and Accounting

The backbone of the climate change regime, and in particular of the Kyoto Protocol, are the national greenhouse gas inventories which form the basis of the highly complex reporting and monitoring system. Guidelines for the national systems of greenhouse inventories, including their methodological basis, are provided by the experts of the International Panel on Climate Change (IPCC) with the approval of the Conference of the Parties.[17] With a view to including adequate methodologies by which emissions avoided by CCS can be estimated, monitored and reported, these Guidelines were revised in a manner that gives due regard to physical leakage from storage and to fugitive emissions from the capture, transportation and injection processes. The development of such new methodologies was finalized by the IPCC in 2006. The new IPCC Guidelines[18] are based on the perception of CCS as a mitigation measure that avoids emissions rather than as a sink.

Similarly, clear rules and methodologies are needed to account for emissions. Adequate and precise accounting is a precondition for reliable assessment of compliance with the quantified commitments. It is also the key to the proper function-

[14] In this sense also Purdy/Macrory (note 5), 15.

[15] Article 2 (1) (a) (iv), Kyoto Protocol.

[16] IPCC Report (note 1), Summary for Policymakers, para. 25.

[17] Article 5 (1), (2), Kyoto Protocol.

[18] Intergovernmental Panel for Climate Change, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, cf. <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm>.

ing of the flexible mechanisms, such as emission trading and clean development, because both systems must be able to account reliably for the emissions that were avoided or removed. Again, the special characteristics of the technology require specific methodologies. The challenge is to account adequately for physical leakage, but also for the additional energy requirements needed under CCS, as well as long-term liability issues.[19] An emission reduction through CCS differs from other emission reductions in the sense that it avoids the release of emissions into the atmosphere, but poses the long-term possibility that carbon dioxide will eventually escape. The difficulties, albeit somewhat new, are not however unsolvable. A variety of methodological options such as discounting, the ten-year approach, or temporary credits could provide for an adequate response.[20] Again, these questions must be resolved at the level of the IPCC, which develops the adequate methodologies.

The details of these important adaptation endeavors go clearly beyond the scope of this article. What remains important to note is that adaptation processes are ongoing, which indicates the overall political acceptance of this technology for the fulfillment of obligations under the climate change regime. The development highlights the dependency of a complex and highly dynamic environmental regime on solid and widely renowned expertise such as that of the IPCC and the Subsidiary Body for Scientific and Technological Advice. Only such expertise and its direct influence upon the legal regime can provide for the flexibility needed by a regime to evolve and adapt, and thus to account for and integrate learning processes.

3. The Clean Development Mechanism

A more fundamental change of the current legal framework is nevertheless required if CCS projects should qualify as valid projects under the Clean Development Mechanism (CDM). This mechanism is one of the flexible mechanisms of the Kyoto Protocol by which countries can implement emission reduction projects in developing countries and, in turn, receive credits which count towards their own emission reductions.[21] The basic idea is to achieve reductions of emissions where it is most efficient and combine these emission reductions with technology transfer from developed to developing countries. The Clean Development Mechanism is administered by the Clean Development Executive Board, which was reformed and streamlined at the Conference of the Parties, serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP 1) in Montreal, 2005.[22] The Board takes

[19] For details, consult IPCC Special Report (note 1), chapter 9 section 3.

[20] See for details the IPCC Special Report (note 1), chapter 9.

[21] Compare Article 12, Kyoto Protocol.

[22] See for details Decision 3/CMP.1 of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol on its first session of 28 November to 10 December 2005, included in FCCC/KP/CMP/2005/8/Add.1 of 30 March 2006.

decisions regarding the acceptability of individual projects, relying on guidance provided the Conference of the Parties.[23] An extension of these guidelines with a view to including CCS was one of the heavily discussed issues at the COP/MOP 2 in Nairobi in the year 2006, and a decision on acceptability could not be reached. Rather, the Parties decided to discuss and study the issue further, as a number of unresolved technical, legal and political issues remained.[24] The discussions revealed that CCS is not only a new technology requiring the climate change regime to adapt. It is also a delicate political issue, at least if used under CDM, about which the opinions differ in particular among developing countries. Some developing countries stress the importance of fossil fuels for development and therefore support CCS under the CDM as a means to modernize coal and gas plants. Others, such as the Alliance of Small Island States, expressed concern about CCS as CDM activity, noting the many uncertainties and its limited geographical application, which could exclude many countries. Oil-producing countries aligned with countries of high technological capacities such as Japan in supporting CCS as a CDM activity. The support of the oil-producing countries for the technology indicates the delicacy of accepting CCS. This is the case because, after all, accepting CCS might result in an increased use of fossil fuels while at the same time prolonging the development of sustainable long-term solutions. It thus potentially contradicts the overall objective of the Framework Convention.[25]

III. Admissibility of CCS Under Relevant Marine Protection Treaties

1. The United National Convention on the Law of the Sea[26]

Irrespective of the maritime zone in which CCS is undertaken, these activities must comply with the environmental obligations established by UNCLOS under Part XII. These obligations also apply to the seabed and its subsoil.[27] A general obligation to protect and preserve the marine environment as stipulated in Article 192, UNCLOS, is violated if CCS harms the environment. More specifically and

[23] Decision 4/CMP.1 and 4 Annexes of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol on its first session of 28 November to 10 December 2005, included in FCCC/KP/CMP/2005/8/Add.1 of 30 March 2006.

[24] See the Decision on "Further Guidance relating to the Clean Development Mechanism" of the COP/MOP 2 in Nairobi 2006, available at <www.unfccc.int> (only advance unedited version available at the time of writing).

[25] See also the discussions at the UNFCCC workshop on carbon dioxide capture and storage as clean development mechanism project activities on 22 May 2006, FCCC/KP/CMP/2006/3, in particular para. 30.

[26] United Nations Convention on the Law of the Sea, 10 December 1982, 21 I.L.M. 1261.

[27] The applicability of UNCLOS to the sub-seabed and the subsoil can be deduced from Articles 1.1 (1), 2 (2), 49 (2), 56 (1)(a), 76 (1) UNCLOS. See also Scott (note 6), 65.

narrowly, Article 194 requires states to prevent, reduce and control pollution. Whether CCS constitutes pollution would also be decisive for the applicability of the obligation of Article 195 whereby obliges states must refrain from merely transferring one type of pollution to another area.[28] According to the definition in Article 1 (4), UNCLOS, introducing carbon dioxide via CCS into the sub-seabed would have to be considered an act of pollution if this results – *inter alia* – in harm to living resources. The applicability of all of these norms thus depends on the harmful effects of CCS on the marine environment and the living resources that are part thereof.

As noted above, negative effects of CCS on the environment cannot be entirely excluded and remain essentially a matter of uncertainty. Scientific knowledge about the impact of acidification on deep sea ecology is still incomplete. As a consequence of the danger of physical leakage, uncertainty as to the ecological impact remains even with respect to geological storage, since abrupt or gradual leakage could affect the carbon dioxide concentrations, with potential negative effects on plants, subsoil animals and the groundwater.[29]

While most modern environmental treaties now include a reference to the precautionary principle, which addresses such situations of uncertainty, UNCLOS does not. Even though the International Tribunal for the Law of the Sea has applied the precautionary principle in its provisional measures and under the specific circumstances of the Southern Bluefin Tuna Dispute,[30] this cannot be seen as establishing a general applicability of the principle under UNCLOS. Another possible line of argument in support of the application of the principle could be to accept its customary law status.[31] While a comprehensive assessment of this question is beyond the scope of this article, it should be noted that the precautionary principle has not only found entry in numerous environmental law treaties, but that it was also repeatedly included in reports of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea[32], as well as in recent Resolutions of the United Nations General Assembly with regard to matters of the law of the sea.[33] But even though this suggests a growing importance of the principle in specific contexts, there is indication of continuous differences between the opin-

[28] Article 195, UNCLOS, could only apply if widely interpreted in a purposive manner. Although CCS does not constitute a transfer of a pollutant from one area in the sea to another, it could apply if it is taken into consideration that the emission of carbon dioxide into the atmosphere would indirectly, through global warming and ocean acidification, contribute to pollution of the marine environment.

[29] IPCC Special Report (note 1), Summary for Policymakers, section 22.

[30] International Tribunal for the Law of the Sea, *Southern Bluefin Tuna* Cases (*New Zealand v. Japan*; *Australia v. Japan*), Request for Provisional Measures, Order of 27 August 1999, cf. <www.itlos.org>.

[31] In this manner S c o t t, *supra* note 6, at 72.

[32] Consider for example the discussion of the ecosystem approach which includes the precautionary approach in the Report on the work of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its Seventh meeting, A 51/156 of 17 July 2006.

[33] See for example the UN General Assembly Resolution A/RES/60/31 of 29 November 2005.

ions of states. Therefore, these instances alone may not give rise to general customary law, irrespective of the difficult question of how far UN General Assembly Resolutions can contribute to the emergence of customary law. If – despite a growing tendency towards reaching the opposite conclusion – the precautionary principle is thus not considered applicable to UNCLOS obligations,[34] CCS could not be considered an illegal activity *per se*, but CCS activities would still have to refrain from harming the environment.

While the mentioned norms obviously remain broad and general, UNCLOS achieves concretization and flexibility in a constitutional manner by delegating concrete rule and standard setting to the realm of states or international organizations. This is the case for Article 207 et seq., UNCLOS. The potentially applicable Articles 207, 208, 210 and 211, UNCLOS[35], require states to establish global or international rules to regulate the potentially harmful activities. However, global rules and standards were only established for dumping and pollution from ships. These are, therefore, the international or global rules and standards to which Articles 210 and 211 refer.[36] As is widely accepted, reference is thus made – *inter alia* – to the London Convention and its Protocol, as developed under the auspices of the IMO.

2. London Convention and London Protocol

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)[37] controls dumping by ship-based and platform-based activities. The basic regulatory approach is one of black-listing of substances contained in Annexes.[38] A Protocol to the London Convention (London Protocol)[39], which supersedes the London Convention for its Parties, pursues a more modern approach to environmental protection insofar as it includes references to sustainable development and the ecosystem approach. It basically reverses the regulatory approach of the Convention from a general permission to a general

[34] In this sense seemingly Purdy/Macrory (note 5), at 18.

[35] Article 209 is not mentioned since CCS is – for reasons of practicability – unlikely to be conducted in the Area.

[36] Compare 210 (3) and 211 (1), UNCLOS.

[37] Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter, 13 November 1972, 11 I.L.M. 1291. The London Convention entered into force on 30 August 1975. As of December 2006, 81 states representing 68,01 percent of world tonnage have ratified the Convention.

[38] Annex I prohibits the dumping of the listed substances. Annex II requires a special permission for the substances in that Annex. All other wastes shall only be dumped with a general permit the procedures of which are outlined in Annex III.

[39] 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 8 November 1996, 36 I.L.M. 1, 7-21. The London Protocol entered into force on 24 March 2006. As of December 2006, 30 states representing 19,49 percent of world tonnage have ratified it.

prohibition. The Protocol only allows the dumping of substances specifically mentioned in Annex 1, provided that a permit procedure (Annex 2) has been followed. Moreover, both the London Convention and the London Protocol provide for an obligation for Parties to apply "a precautionary approach".[40]

Regarding the question of the admissibility of CCS under the London Convention and the Protocol, discussions of the relevant and legal issues have been ongoing for some time.[41] Prior to the decisive 28th Consultative Meeting, the Contracting Parties had acknowledged the role of CCS in tackling climate change and ocean acidification. Consequently, the Parties agreed that the London Convention and the London Protocol were the appropriate global legal instruments to address this issue which was seen as falling within the ambit of marine protection.[42] In this context, it is important to note that the discussion under the London Protocol and the London Convention is thus far explicitly limited to the regulation and facilitation of CCS in sub-seabed geological structures.[43] As CCS had not been an issue at the time of the adoption of either instrument, the Contracting Parties had to find agreement on the interpretation of the respective legal terms and, alternatively or in consequence of a particular legal interpretation, amend the London Convention or the London Protocol.

Interpretational difficulties arise with regards to the definitional scope of dumping. In reproducing the definition under UNCLOS, dumping is defined by the London Convention as "any deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms"[44], but excludes "placement of matter for a purpose other than the mere disposal thereof"[45].

One problem is that CCS that is conducted through pipelines directly from land does not fall under the scope of either instrument. Further, it could be argued that the exception applies to CCS since carbon dioxide is not really thereby disposed of, but arguably only placed into the sub-seabed for a period of time until the climate change issue has been resolved through the development and employment of cleaner energy.[46] However, an interpretation of the exception clause should be guided by the purpose and aim of the Convention, which is to protect the marine environment. In light of this aim, it seems more convincing to argue for a narrow reading of the exception. Thus, only such placement of matter should be considered excluded which is introduced into the sea in order to serve a more immediate

[40] Article 3 para. 1 London Protocol. Although not provided for in the text of the London Convention, Contracting Parties to the London Convention have agreed to apply the precautionary approach within the framework of the London Convention, Resolution LDC.44(14).

[41] See e.g. the Report of the 27th Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter 1972 of 24-28 October 2005, LC 27/16 of 16 December 2005, section 6.

[42] See ibid., executive summary, para. 5 and section 6.

[43] See already ibid., in particular section 6 paras. 24 and 25.

[44] Article III para. 1 (a) (i) London Convention, Article 1 para. 4.1.2 Protocol.

[45] Article III para. 1 (b) (ii), Article 1 para. 4.2.2.

[46] Such an argument is discussed by Purdy/Macrory (note 5), 23.

purpose which does not raise the danger of marine pollution, as for example an artificial reef. With a view to the aims of the Convention and the Protocol, the placement of carbon dioxide which potentially endangers the marine environment should not be justified by some relatively remote purpose which does not constitute an alteration of the function of the matter itself.[47]

Another difficulty results from the lack of concretization of what constitutes "at sea" under the London Convention. While the London Protocol explicitly includes the sub-seabed and the subsoil thereof in its definition of what constitutes dumping "at sea",[48] and therefore includes sub-seabed activities in its scope of application,[49] the respective scope of application of the London Convention is not as clear. Under the Convention, the term "sea" means "all marine waters other than the internal waters of States",[50] and therefore does not explicitly apply to the sub-seabed. The application of the London Convention to the seabed and the subsoil thereof was subject to intense debates in relation to the question of admissibility of storage of nuclear waste beneath the sea in the 1980s and the beginning of the 1990s. Since the discussion did not culminate in a clear decision on the question, the scope of application is again subject to treaty interpretation.

A purposive interpretation must again take into account the objective of the Convention, which is to promote the "effective control of all sources of pollution of the marine environment".[51] What matters is whether the activity could be a source for pollution of the marine environment. If a substance such as carbon dioxide potentially endangers the marine environment, it should not make a difference where exactly the matter is placed, i.e. whether this is in the water column or underneath. Decisive are thus the potential effects of activities of dumping irrespective of their place of disposal. Such a reading does not extend the definition in an unpredictable way. It simply restricts the term "at sea" to a description of the place of the mechanism of disposal, which may include dumping from vessels, aircraft or structures.[52]

Thus falling under the scope of both the London Convention and the London Protocol, CCS would have to be listed under Annex 1 of the London Convention if it should be prohibited,[53] and it would have to be listed in the reverse list of Annex 1 of the Protocol if it was to be an allowed activity for the Parties to the London Protocol.

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[47] Similarly Scott (note 6), 76 Article 77 (who adds that a different assessment would only apply in the case of the placement of carbon dioxide as part of scientific experiments).

[48] Article 1 para. 7, London Protocol.

[49] Article 1 para. 4.1 (1) describes dumping as "any deliberate disposal at sea". In conjunction with Article 4 of the London Protocol, sub-seabed activities are thus under the same restrictions as an activity that affects the water column.

[50] Article III para. 3, London Convention.

[51] Article I, London Convention.

[52] With the same result Scott, *supra* note 6 at 76.

[53] Compare Article IV (a), London Convention; Article 4 para. 1.1 London Protocol.

Since 1996, Annex 1 under paragraph 11 of the London Convention entails a reference to "industrial wastes", defined as "waste materials generated by manufacturing or processing operations".[54] Without going into details, it should be noted that seven Consultative Meetings have so far not managed to produce agreement on a workable interpretation of the term.[55] Although the application of a precautionary approach could provide an argument in favor of a wide interpretation of "industrial waste" to include CCS,[56] the obvious disagreement on this issue cannot be disregarded. In light of these differences, it can be safely assumed that at least so far, CCS is not explicitly prohibited under the Convention.

The different regulatory approach of the Protocol, which requires a listing of carbon dioxide, necessitates an adjustment of the Protocol, if CCS is to be allowed. Such an amendment to Annex 1 was decided upon at the First Meeting of Contracting Parties to the London Protocol on 2 November 2006.[57] The Parties decided to include carbon dioxide streams from carbon capture processes for sequestration under the condition that CCS is placed in sub-seabed geological formations, that it overwhelmingly consists of carbon dioxide, and that no other wastes are added for the purpose of disposal.[58]

The decision contains a number of interesting aspects. By deciding to include CCS in sub-seabed geological formations in Annex 1, the Contracting Parties recognize climate change mitigation as being of concern to the marine environment, and consequently see CCS as a protection measure. But even though the Parties agreed on that point, the question whether to take action or not largely depended on how to interpret and apply the obligation to pursue a precautionary approach. Two opposing arguments both relied on this approach,[59] highlighting the inherent vagueness of the precautionary principle. Action and non-action become justifiable depending on whether one stresses the already known or the not yet known. A strong argument could be and has been made that a truly precautionary approach should result in more caution, at least until overwhelming evidence exists that carbon dioxide would remain in the proposed repository and not have any harmful effect on the marine environment.[60] As a minimum, Denmark argued, specific

[54] Annex 1 para. 11, London Convention.

[55] See Report LC 27/16 (note 41), section 7 para. 1.

[56] In this manner Scott (note 6), 78.

[57] See Resolution LP.1(1), adopted on 2 November 2006, included in Report of the Twenty-Eighth Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and First Meeting of Contracting Parties to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 of 30 October-3 November 2006, LC 28/15, para. 102 (12 Parties voted in favor, and 5 Parties abstained).

[58] See Resolution LP.1(1) (note 57).

[59] See Report LC 28/15 (note 57), paras. 82-83.

[60] In this sense the delegations not in favor of the amendment, see Report LC 28/15 (note 57); Purdy/Macrory (note 5), 24.

technical guidelines should be in place when adopting the amendment.[61] Nevertheless, the amendment was agreed to in the absence of such guidelines, which are however to be adopted in the Second Meeting of Contracting Parties.[62]

Of course, one can only speculate on the political motives behind the decision. Economic interests that usually strongly support CCS might have been influential. The relatively lax application of the precautionary approach in the context of a treaty that entails a particularly pro-active and wide formulation regarding precaution may also be explained by the new and to some extent unique issue that Contracting Parties encounter with respect to CCS. They have to choose between taking preventive and possibly necessary measures to mitigate climate change, and thus protecting the marine environment from acidification, on the one hand, and not taking any measures, and thereby paying full respect to the precautionary principle which equally serves the environmental goals of the treaty on the other. In a way, the issue amounts to a unique conflict between the preventive principle, which demands preventive action to tackle proven environmental dangers (ocean acidification), and the precautionary principle, which demands caution in the absence of scientific certainty.

Over all, the decision of Parties to the London Protocol seems to represent a compromise that might be capable of achieving the needed balance between both conflicting goals. Strict procedures of assessment and long-term monitoring adapted to the specific requirements of CCS are therefore key to proper implementation of this delicate balance. The Specific Guidelines for the Assessment of Carbon Dioxide Streams into Sub-seabed Geological Formations should already have been developed, but are now a matter of first priority for the Parties.

The development is also remarkable in terms of harmonization and cooperation across the different environmental treaty regimes. The discussion at OSPAR and the work of the IPCC is specifically referred to as reference points in the negotiations and decisions of the London Protocol. The outcome of the discussions and related documentation was also instantly communicated to the UNFCCC and Kyoto Protocol negotiations of November 2006.[63] This illustrates the close cooperation between environmental treaty regimes particularly in respect of cross-cutting issues beyond legal requirements.

Finally, the relatively quick response of the Parties to the London Protocol was greatly facilitated by a particularly flexible format (Annexes) and flexible procedures. While changing either the Protocol or the Annex only requires a two-thirds majority of those present at the meeting of Contracting Parties[64], an amendment of the Annex enters immediately into force for the Parties that have agreed to it, and for all the others 100 days later if they do not opt out.[65] An amendment to the Pro-

[61] See Report LC 28/15 (note 57), para. 96.

[62] See Resolution LP.1(1) (note 57); Report LC 28/15 (note 57), para. 106.

[63] LC 28/15 (note 57), para. 109.

[64] Compare Articles 21 (2) and 22 (2), London Protocol.

[65] Article 22 (4), London Protocol.

tocol requires ratification by two-thirds of the Parties.[66] The inherent additional flexibility of the Annexes comes at the price not only of an erosion of consent, but also, since ratification is not required, means lesser participation by national parliaments.

In order to further enhance the protection of the environment, parties to London Convention and Protocol are encouraged to create regional agreements that further their objective and are consistent with them.[67] One such agreement is the Convention on the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).

3. OSPAR

The OSPAR Convention[68] is a framework agreement which seeks to control all sources of pollution and thereby protect a geographically limited "maritime area".[69] The "maritime area" is defined as "the internal waters and the territorial seas of the Contracting Parties, the sea beyond and adjacent to the territorial sea under the jurisdiction of the coastal state to the extent recognised by international law, and the high seas, including the bed of all those waters and its sub-soil"[70] of a specifically designated geographical area of the North-East Atlantic. The wording thus includes sub-seabed geological formations. Arguments to the contrary which rely on a distinction between the sub-soil and sub-seabed are hardly convincing, in particular in light of the purpose and ecosystem approach of the Convention. The Group of Jurists and Linguists reporting to the OSPAR Commission, which gave a detailed assessment of the CCS related questions in 2004, likewise included all underground strata within the scope of the Convention.[71]

The general provisions and several Annexes of the OSPAR Convention set out one of the most comprehensive and strictest legal frameworks for marine environmental protection in existence. It is based on a precautionary and ecosystem approach as well as the polluter-pays principle.[72] For present purposes, the detailed obligations of the Convention on pollution from land-based sources (Article 3 and Annex I), pollution by dumping (Article 4 and Annex II) and pollution from offshore sources (Article 5 and Annex III) are of particular interest.

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[66] Article 21 (3), London Protocol.

[67] Article VIII, London Convention; Article 12, London Protocol.

[68] Convention on the Protection of the Marine Environment of the North-East Atlantic, 22 September 1992, 32 I.L.M. 1072 (entry into force 25 March 1998).

[69] Article 2 para. 1 a), OSPAR Convention.

[70] Article 1(a), OSPAR Convention.

[71] See OSPAR Commission, Report from the Group of Jurists and Linguists on Placement of Carbon Dioxide in the OSPAR Maritime Area, in Summary Record, OSPAR 2004, OSPAR 04/2371.E, Annex 12 (2004), para. 11; cf. <www.ospar.org/eng/html/meetings>.

[72] Compare Article 2, OSPAR Convention.

Annex I does not establish a general prohibition, but rather stipulates substantive conditions and a system of authorization for pollution from land-based sources. CCS conducted directly from land, for example through pipelines, is therefore not prohibited by the Convention, but remains subject to authorization by the competent authority.[73]

In contrast, Annexes II and III establish a general prohibition of dumping from vessels and from offshore installations. For the purposes of the Convention, "dumping" means "any deliberate disposal of wastes or other matters"[74]. This does not include the "placement of matter for a purpose other than the mere disposal thereof, provided that, if the placement is for a purpose other than that for which the matter was originally designed or constructed, it is in accordance with the relevant provisions of the Convention".[75] The basic tenets of these definitions hardly deviate from the respective provisions under UNCLOS and the London Convention as already discussed above. In light of the even more stringent environmental aims of the OSPAR Convention, the above-made argument for a narrow purposive interpretation of the exception must equally apply here. It is even reinforced by the explicit qualification that any exceptional placement must comply with the provisions of the Convention. The findings of the Group of Jurists and Linguists support this conclusion,[76] and consequently CCS by ships or from offshore-installation generally falls within the category of dumping.

Since carbon dioxide is neither mentioned nor contained within any of the exceptions mentioned in Annex II, shipment in a vessel for placement from the vessel would therefore be prohibited under Annex II. The general prohibition of pollution from offshore sources for all substances in Article 3 of Annex III also leads to a prohibition of CCS resulting from offshore sources such as oil platforms, except if it arises from the operation of the offshore installation itself.[77] This exemption applies to CCS which constitutes a re-injection of carbon dioxide emitted by the offshore installation.[78] According to a wide interpretation of the Group of Jurists and Linguists, CCS as part of enhanced oil and gas recovery also falls under the exemption, even if the carbon dioxide utilized stems from other sources.[79]

The categorization of CCS arising from man-made structures specifically designed for conducting CCS activities is more difficult. One possible option in this case would be to rely on the wide definition of vessels under the OSPAR Convention, which in rather general terms includes "man-made structures in the maritime

[73] Compare Report from the Group of Jurists and Linguists (note 71), paras. 15-18.

[74] See Article 1(f), OSPAR Convention.

[75] Article 1(g)(ii), OSPAR Convention.

[76] Report from the Group of Jurists and Linguists (note 71), para. 20.

[77] Article 3 para. 2 of Annex III to the OSPAR Convention.

[78] Compare Articles 2 and 3 of Annex III, OSPAR Convention. For the same result see Scott (note 6), 82.

[79] Report from the Group of Jurists and Linguists (note 71), para. 20.

area"[80] that are not ships.[81] Another possible categorization is based on the equally broad definition of land-based pollution which includes "sources associated with any deliberate disposal under the sea-bed made accessible from land by tunnel, pipeline or other means and sources associated with man-made structures placed in the maritime area under the jurisdiction of a Contracting Party, other than for the purpose of offshore activities".[82] Although this latter provision seems to be applicable at first sight, it is important to consider the consequences of such a qualification of CCS stemming from man-made offshore structures as a (generally allowed) land-based activity. First of all, it would establish a distinction between CCS in the sub-seabed and CCS in the water column, as only the latter would then be prohibited under Annex II.[83] Similarly, it seems – in light of the environmental aims of the Convention – hardly convincing that a distinction should be made between CCS conducted by ships and CCS conducted from a platform specifically installed for such a purpose. A qualification of CCS as land-based pollution would also increase the inconsistencies arising from the regulatory approach of the OSPAR Convention when applied to CCS, at the root of which is the distinction according to the means of placement and not according to the effects on the environment.

This inconsistency of the OSPAR Convention which surfaces in cases of CCS becomes even more apparent when looking at the results of an analysis of the admissibility of CCS under OSPAR. The placement of carbon dioxide through a pipeline from land is generally allowed (subject to national authorization procedures), whereas CCS from a vessel or from an offshore installation is prohibited. The OSPAR regime does not differentiate between effects of CCS placements on the marine environment, but rather by the method and purpose of placement. Thus, placements with different impacts on the environment (for example, CCS in a water column and CCS in the sub-seabed) may not be distinguished, while different methods of placement (i.e. dumping or pollution through pipelines) are treated differently even though the environmental danger is the same.[84] The inconsistencies which result from the differentiation between land-based CCS and CCS from vessels or installations could however be remedied if politically wished.

Realizing the lack of an adequate regulation of CCS under the OSPAR Convention, as well as the danger of ocean acidification and the potential benefit of CCS, the OSPAR Commission has recognized a need for action at its meeting in June 2006.[85] Although a decision was not taken, the Commission established an Interna-

[80] Article 1(n), OSPAR Convention.

[81] This is argued by the Group of Jurists and Linguists. See Report from the Group of Jurists and Linguists (note 71), paras. 19, Article 22.

[82] Article 1(e), OSPAR Convention.

[83] Scott (note 6), 84.

[84] This was also noted by the Group of Jurists and Linguists (note 71), para. 32.

[85] See OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, Meeting of the OSPAR Commission, Stockholm, 26-30 June 2006, OSPAR 06/23/1 Annex 4 (Ref. § 2.4a), Terms of reference for the intersessional correspondence group on the placement of CO_2 in sub-seabed geological formations (ICG-CO_2), section 0 (stating that "ocean acidification and other

tional Consultative Group (ICG) with the mandate to study and outline options for action. The ICG was asked to "develop a menu of options to clarify and, if appropriate, amend the OSPAR Convention and/or its annexes and appendices, with a view to facilitating and/or regulating the placement of carbon dioxide in sub-seabed geological formations".[86] This includes the development of an adequate framework for risk assessment and management which takes into account risks of leakage, likely effects on the environment, monitoring and mitigation measures, including long-term risks.[87] Another issue to be addressed is liability.[88]

Interestingly, the ICG was explicitly asked to take into consideration decisions not only of the Group of Jurists and Linguists, but also those taken by the IPCC and under the London Convention and the Protocol.[89] This orientation of OSPAR at the London Convention is not a matter of voluntary treaty coordination, but responds to the hierarchy between the two agreements, as mentioned above. OSPAR must remain consistent with the London Convention and its Protocol.[90] Judging from the terms of reference of the ICG, it hardly appears to be a farfetched speculation that an adjustment of Annex II of the OSPAR Convention allowing CCS for sub-seabed geological formations can be expected in the near future. However, a contrary decision would not lead to conflicting obligations, but rather restrict rights of London Protocol Parties through OSPAR. It should be interesting to see how Parties interpret and apply the precautionary principle, which was already a debated issue within the Group of Jurists and Linguists in 2004.[91]

If CCS is to be allowed, an amendment of Annex II is the likely option, because it is easier than an amendment of the main text. It only requires a three-fourth majority of Contracting Parties in contrast to the unanimous vote necessary for a change of the Convention. This can again be taken as a demonstration for the flexibility of modern environmental treaties in coping with the rigidity of traditional consent and ratification requirements.

IV. Conclusion

The battle against climate change is an issue which is not confined to the FCCC and the Kyoto Protocol. With new climate change research, it becomes more and more apparent that it is an issue which affects all human activity, and all ecosystems on which we depend. Simple logic indicates that it is and will become a pri-

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effects on the marine environment caused by elevated emissions of CO_2 are a cause of serious concern").

[86] Terms of reference (note 85), para. 1.1.

[87] Ibid., para. 1.4.

[88] Ibid., para. 1.1.

[89] Ibid., para. 0.4.

[90] Article 12, London Protocol.

[91] Terms of reference (note 85), para 9.

mary example of a regulatory concern which equally transcends legal boundaries and functional differentiations between different treaty regimes. The example of CCS shows that treaty regimes and organizations other than those directly concerned with the climate change regime are starting to address the issue not only because of the necessity of states to fulfill their obligations under the climate change regime, but also to fulfill the objectives of these particular regimes.

The resulting pressure for coordination has so far been met through informal cooperation. While some (informal) mechanisms for policy and legal coordination are emerging, it remains doubtful whether this is sufficient. The example of marine environmental protection as shown in this article hints at one possible option besides informal coordination: an umbrella treaty (UNCLOS) delegating norm-elaboration and norm-setting responsibilities to organizations (IMO) and legally related international (London Convention and Protocol) and regional (OSPAR) treaty regimes which must remain consistent with each other.

The legal portfolio in particular of environmental law must also be able to accommodate learning processes and respond to new technological developments. Modern environmental treaties contain a number of flexible tools which allow for a quick response to new technological developments such as CCS, including expert participation (IPCC), informal and formal secondary law (guidelines for reporting and inventories, COP decisions), as well as flexible amendment procedures. The emerging relative independence of treaty bodies and the shift to executive (majority) decision-making on both international and national levels are signs for the emergence of an international administration as a consequence of functional necessities.

Newly arising interdependencies in environmental protection and constant technological advancement must be based on well-grounded and coordinated concepts of how to deal with uncertainty. The centrality of the precautionary principle in this regard was once more demonstrated in the discussions under OSPAR and the London Protocol. At the same time, it has become apparent that international environmental law would greatly benefit from both increased clarity and general applicability of this principle. The political choices needed in this regard are particularly difficult. In complex matters such as CCS, non-action for reasons of precaution might turn out to be the strategy that forestalls actions required for effective climate change mitigation. It is hoped that the right balance will be struck, and that action in respect to CCS will neither inflict environmental harm on ecosystems nor postpone efforts towards an age of clean energy.