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Re: Draft Directive on the geological storage of carbon dioxide

Dear Mr Brockett,

As you are preparing the legislation to regulate the use of carbon capture and storage in the European Union, we would like to present some of our views on important aspects of this framework.

In general, Greenpeace does not support carbon capture and storage (CCS), due to the critical risks, limitations and uncertainties associated with the technology. We are opposed to any financial or political priority given to CCS at the expense of the real solutions to climate change in the energy sector: the promotion of renewable energy and energy efficiency.

The *environmental risks* of CCS include (but are not limited to):

- Reservoir leakage: the slow, long-term release of carbon dioxide from storage sites, for instance through faults;
- Sudden leakage: the large-scale release of carbon dioxide from storage sites, for instance through failures of active or abandoned injection wells;
- Escape of carbon dioxide into shallow groundwater;
- Displacement of deep brine and mobilisation of toxic metals and organics which may result in contamination of overlying sediments and marine waters or of potable water;
- Escape of other hazardous gases and materials captured with the carbon dioxide stream.

From an environmental point of view, no leakage is acceptable. Furthermore, on a global scale, leakage of carbon dioxide from CCS operations, whether during or post injection, has the potential to offset climate change mitigation efforts.

The overall *potential* of CCS (if it does become commercially available) to reduce emissions to the atmosphere depends on the fraction of carbon dioxide captured, the level of increased carbon dioxide production required by CCS, and levels of leakage from transport and storage sites in the long term.

An additional concern exists with respect to the *energy penalty* associated with CCS; the IPCC Special Report on CCS gives a range of between 10-40% depending on the type of power station and the process used. Each of the three components of CCS - capture, transport and storage - requires additional energy inputs.

Furthermore, we would argue that *enhanced oil recovery* (the storage of carbon dioxide in depleted oil and gas fields) should not be allowed in the EU, given its overall climate penalty. From a net carbon dioxide perspective, enhanced oil recovery does not mitigate climate emissions. A recent Norwegian Research Council Report estimates that injecting one tonne of carbon dioxide will yield 0.6 tonnes of oil that will eventually generate 3.2 tonnes of carbon dioxide.

Given all these concerns, Greenpeace is not in favour of CCS becoming mandatory in new power plants. Rather than advocating this specific emission reduction technology, we urge the European Commission to tackle the broader issue of new-build of fossil-fuelled power plants in Europe. Any decision to build a new coal plant will inevitably increase greenhouse gas emissions, and has to be deemed as incompatible with the existing climate commitments by the EU.

Some of our detailed comments on potential elements of the future CCS legislative framework are outlined below.

Marine storage

We fully support the EU position to ban storage of carbon dioxide in the water column, and the explicit decision already taken in this regard by the Contracting Parties to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention). Ocean storage would result in greatly accelerated acidification (reduction of pH) of large areas and would be detrimental to a great many organisms - if not entire ecosystems - in the vicinity of injection sites. Carbon dioxide disposed of in this way is also likely to get back into the atmosphere in a relative short time.

With respect to storage in sub-seabed formations, Greenpeace is of the opinion that the draft legislation on CCS should explicitly recognise the higher level of uncertainty and operational difficulties associated with managing CCS technology in the marine environment.

It should further acknowledge specific legislative frameworks linked with protecting nature and biodiversity in the European Union, in particular the Birds, Habitats and Marine Directives, and should require all applications for exploration and storage of CCS in sub-seabed formation to be assessed against the goal of achieving a good environmental status in the marine environment, as defined by the EU's Marine Strategy Directive (pending its adoption). Furthermore, the CCS legislation should be consistent with the provisions of the OSPAR Convention and the London Protocol.

It is worth noting in this context that transport (i.e. export) between member states who are parties to the London Protocol, for the purposes of sub-seabed CCS, is currently illegal under the terms of the Protocol (Article 6). This provision was included in the text of the Protocol - and agreed upon by all Parties - for good reasons and remains integral and essential to the success of the Protocol in meeting its objectives.

As stated earlier, from an environmental point of view, no leakage is tolerable. This is also necessary for consistency with the aim to ensure 'permanent containment' of carbon dioxide streams disposed of into sub-seabed geological formations expressed within the Specific Guidelines recently adopted by Contracting Parties to the London Protocol.

In closing, it is vital to ensure that the provisions and aims of the London Protocol will not be undermined through the development and/or implementation of the EU

CCS Directive, not least because the removal of barriers for specific purposes can result in other unintended, and possibly unforeseen, consequences.

For an explanation of some of the additional environmental concerns associated with this specific topic, please also refer to the Annex in the end of this document.

'Capture-ready'

We believe that the pursuit of CCS as a climate mitigation solution is unwise, given the lack of technological maturity of CCS, as well as doubts over its eventual commercial viability. The requirement to construct "capture ready" power plants puts hope in an end-of-pipe technology that may or may not be realized in time to address carbon dioxide emissions from the power sector.

Greenpeace is therefore opposed to a binding requirement for new plants to be 'capture ready'.

Permitting process

Greenpeace would support a strengthened role by the European Commission and the European Parliament in the process of issuing geological storage permits. If, for example, a project does not fulfil all environmental requirements, the Commission or the European Parliament should be able to reject a permit proposal until they are satisfied that action has been taken and that these requirements are met.

Furthermore, in certain cases, the carbon dioxide stream might be crossing national boundaries (intentionally or unintentionally). If such a possibility exists, then the concerned Member State(s), whose territory might also be crossed, should also have an official role (including the power to reject a proposal) in the permitting process.

Transparency

All data, including exploration and inspection reports should be available to the public, in the interest of transparency, irrespective of whether some companies might prefer to keep geological data confidential. The permitting authority and the public should be able to access such data at all times.

Composition of the stream

The scientific literature indicates that a site's storage integrity can be significantly affected by the presence of other substances in the carbon dioxide stream. Given the current uncertainty surrounding the effect of stream composition on the stability of the site and its infrastructure, it will be essential that captured carbon dioxide streams are of very high purity (i.e. the highest purity technically achievable which can also be safely transported and injected).

The precise composition of a carbon dioxide stream and its expected variability over the proposed period of injection (including details and concentrations of impurities arising from the capture process and of any substances added deliberately to prevent corrosion or otherwise improve the safety of the transport and injection processes) must be reported as part of the geological storage permit application process. If the stream is not fully characterised and/or could contain types and levels of other substances exceeding those which would be consistent with the carbon dioxide stream being of very high purity (as defined above), then a permit should not be granted.

Additionally, the purity of the stream has to be assessed continuously as part of the verification process.

Exploration permits

The selection of the appropriate storage site is fundamental in determining the long-term security of geological storage. Therefore, sufficient time should be granted for completing this process. Undertaking a proper site selection may last longer than two years, so exploration permits should not expire after this period of time. For example, data for natural CO2/CH4 fluxes in the soil undergo seasonal changes, and such fluxes have to be measured over a significant period (longer than two years) so that robust background information can be obtained.

Characterisation and assessment criteria

We understand that some important criteria are currently missing from the draft legislation's requirements. Firstly, the data for natural CO2/CH4 fluxes in the soil should be included, as mentioned above. It is also important to include information on all wells in the proposed storage area and neighbouring formations, which also requires an evaluation of the final distribution of the carbon dioxide plume in the storage formation. Additionally, a refilling plan should be finalised before a storage permit is given out (especially given that old wells are not sealed with carbon dioxide resistant cement and thus pose a risk for leakage).

Monitoring plan criteria

The monitoring plan should not only cover the period of active injection, but extend well into the storage phase when injection has ceased. It should also include proposals for monitoring the impacts of any construction or other activities associated with the CCS project and a baseline survey of conditions in the reservoir and in the overlying sediments and water column in order to facilitate the detection of any significant changes over time during injection and/or long-term storage.

The choice of monitoring technology is important, as it provides necessary information on the carbon dioxide behaviour in the geological formations in the vicinity of the injection well. Depending on the storage formation and the amount of stored carbon dioxide, 'vicinity' could encompass an area kilometers away from the injection point. This information must be included in a continuous monitoring programme. Three-dimensional and other geophysical measurements are essential to model the carbon dioxide plume behaviour and compare it with simulations.

A timeframe for post-closure monitoring must also be defined. Given that the precise period will depend on too many factors, an approximation of the timeframe would be sufficient. An operator must undertake post-closure monitoring for hundreds of years. The permit applicant must guarantee financing for post-closure monitoring over this period, otherwise a permit should not be granted.

Length of responsibility

The operator should remain responsible for the storage for as long as the operator's post-closure monitoring takes place and for an additional period that will act as a security buffer. The total period of responsibility would therefore last over hundreds of years.

Harmonisation across member states of financial provisions and penalties

Experience through other EU policies (for instance, the emissions trading scheme) shows that harmonisation across member states is a prerequisite for creating a level-playing field and for comparable implementation. In the case of this legislation, uniform penalties must be set in the regulatory framework.

A segregated fund must be established in order to meet all categories of liability, including the cost of monitoring, corrective measures, closure and post-closure activities.

Thank you for your consideration of these points.

With kind regards,

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ANNEX:
CONCERNS WITH RESPECT TO STORAGE IN SUB-SEABED FORMATIONS

Compared to terrestrial ecosystems, the oceans are still poorly understood (and the ecology of sub-seabed microbial communities still less so), and biological impacts of carbon dioxide storage will be difficult to anticipate. The planet's seas and oceans hold the largest share of biomass, particularly on and along the continental shelves. Even a slow seep of carbon dioxide from an aquifer could have serious implications for marine ecology, if not directly for terrestrial systems. Moreover, extreme environmental conditions and the possibly great sub sea-level depth of operations, increases the risk of accidents, difficulties in monitoring and mitigation and uncertainties in planning.

One aspect of potential environmental impact that has received little attention is the impact upon sub-soil ecosystems. Although surficial terrestrial systems have been extensively researched in terms of their microbial ecology and the way in which this relates to other soil organisms, far less work has been carried out to investigate deep, sub-soil microbial communities and the wider ecological interactions which they may have. Given the possible biomass of these communities (based simply upon the sheer volume of habitat that is available for them to occupy), this seems a substantial indeterminacy. Recent work (Cowen et al. 2003) has shown that a diverse (though relatively low biomass) microflora exists in the ocean basin crust consisting of organisms related to known nitrate and sulphate reducers together with heterotrophic organisms. Other work suggests that deep subsurface microbial systems are defined by heterogeneous physico-chemical conditions in subsurface environments (see: Brockman and Murray 1997) and that microbial life is widespread within the whole depth of the earth's crust including extreme temperature systems (see: Vorobyova et al. 1997). The overall functions of these deep microbial communities are unknown and the subject of considerable debate (Kerr 2002). Impacts upon these ecosystems due to carbon dioxide storage could be substantial but their consequences are largely unknown.

To date, none of the proposals has addressed the potential ecological role of these deep formations or described any of the associated ecosystems. Carbon dioxide disposal in concentrated form, as in sea floor formations, is likely to have severe local impacts. Any seep at the seabed could cause widespread changes in benthic and water column ecology.

The remoteness and depth at which sub-seabed storage will take place makes monitoring and verification, and, in particular, a commitment to long-term monitoring, significantly more difficult. In this context, it should be noted that monitoring and verification does not end when the storage reservoir is capped. Post-operational monitoring over hundreds of years is essential.

However, in the case of sub-seabed storage, seismic techniques used to monitor storage reservoirs may, in themselves, have detrimental effects on marine life, including whales, dolphins and seals.