Carbon Capture and Storage and the London Protocol
The Regulation of Continental Shelf Development, Halifax, Nova Scotia

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Did we do it?

- **Global Warming:**
  - A hoax?
  - Are we to blame?
  - Can we fix it?
  - Can we afford to fix it?
Path to Limit Warming to 2°

Carbon Capture and Storage is the only mature technology that can significantly reduce CO$_2$ emissions from the burning of fossil fuels.
Without CCS, overall costs [...] increase by 70% (IEA).

How to achieve the 2030 goal:
Abatement of the 13.8 Gt CO₂ equivalents necessary to keep average temperature rise at 2°C can be achieved through four main measures. The percentages show how much each measure is estimated to account for.

57% EFFICIENCY
23% RENEWABLES & BIOFUELS
10% NUCLEAR
10% CARBON CAPTURE AND STORAGE

AN ADDITIONAL $10.5 TRILLION of investment is needed in total in the +2°C Scenario, with measures to boost energy efficiency accounting for most of the abatement through to 2030.

If we continue as is, it is estimated that the world average temperature will rise with 6°C.

Source: IEA (International Energy Agency)
**CCS – What is it?**

- Capture: Separation of “pure” carbon dioxide from flue-gas or from natural gas, followed by compression and transport of the CO$_2$ stream to a storage site.

- Storage: Injection of CO$_2$ stream into a suitable deep subsurface formation, accompanied by monitoring to ensure “permanent” isolation from atmosphere and environmental or economic receptors in the subsurface.

- Injection of CO$_2$ for enhanced oil recovery may also qualify as climate change mitigation measure.

**Graphic: NA CCS Atlas**
**Offshore storage projects**

- **Sleipner (Norway)**
  - First CCS project in the world (1996)
  - Incentivised by Norwegian tax
  - Natural gas processing
  - 1 Mtpa injected from Sleipner platform into Utsira formation, a deep saline formation below the Norwegian continental shelf.

- **Snohvit (Norway)**
  - CO₂ captured at Melkoya LNG terminal, transported 150 km to subsea template, and injected at 2600 m depth into Tubaen formation.
  - 0.5 Mtpa injected since 2008.

- **Gorgon (Australia):** To be operational 2014
- **UK/Netherlands:** Options being considered.
UNCLOS on CCS

- Rights to inject CO$_2$ into formations in the continental shelf that are shared with neighbouring countries may require bilateral agreements.

- CO$_2$ can be injected by all states below the seafloor in the high seas provided that they have due regard to the interests of other states and the requirements of international law.

- CO$_2$ classification not established.
London Convention and Protocol

- Global agreement regulating disposal of wastes at sea.
  - Convention 1972 (86 countries)
  - Protocol 1996 (40 countries as of Oct 2011)

- Amendment to Annex 1 of protocol adopted Nov 2006 - came into force 10 Feb 2007 – to allow disposal in geological formations.

- Article 6: “Contracting Parties shall not allow the export of wastes or other matter to other countries for dumping or incineration at sea.”

- Basel Convention on the Control of Trans-Boundary Movements of Hazardous Wastes and Their Disposal:
  - Not yet considered carbon dioxide transport, classification is key.
London Protocol Article 6
EXPORT OF WASTES OR OTHER MATTER

- Article 6 interpreted to prohibit trans-boundary transport of CO$_2$ for geological storage.

- Amendment proposed by Norway April 2009 was adopted at annual Consultative meeting in October 09.
  - “Export of CO$_2$ for disposal […] may occur, provided an agreement or arrangement has been entered into by countries concerned”
  - Trans-boundary migration in geological formation is not export.

- The amendment needs to be ratified by 2/3 of all parties
  - Unlikely in the near term, only some of the parties are considering CCS, and less are interested in offshore storage.
Options for overcoming the Article 6 barrier

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<th>Option</th>
<th>When and how</th>
<th>Advantage</th>
<th>Disadvantage</th>
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<td>1. Clarification of Article 6 by Interpretative resolution</td>
<td>By resolution at a meeting of contracting parties</td>
<td>Fast-track</td>
<td>Conflicts with adoption of amendment - may derogate from the ratification process</td>
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<tr>
<td>2. Provisional application of 2009 amendment by resolution</td>
<td>By resolution at a meeting of contracting parties</td>
<td>Fast-track, consistent with 2009 amendment, more likely to receive support than opt. 1.</td>
<td>Contracting parties may not agree to provisional application.</td>
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<td>3. Bilateral or multilateral agreement between parties</td>
<td>Parties could enter into negotiations Immediately</td>
<td>Parties could negotiate terms suitable to them, among themselves</td>
<td>More time and effort will likely be required than for opt. 1 and 2.</td>
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Hungry for more?

- www.nacsap.org/
- www.ccs101.ca/
- www.dnv.com/

- Please feel free to contact me: jorg.aarnes@dnv.com
Uncomfortable Truths

- Increasing populations and energy demand: Asia on the rise
- Climate change won’t disappear: Need to cut emissions - everywhere
- Fossil fuels: Our bread and butter
  - No more easy oil
  - Coal is here to stay
  - Dash for gas
- Renewables not enough
Canadian CO₂ emissions

- Emission reduction commitments
  - Canada: 17% below 2005 levels by 2020 (Copenhagen accord)
CCS Opportunities in NS

• 4 coal fired power plants.

• Onshore storage potential near Lingan and P. Aconi.

• Ongoing study to examine offshore potential.
Regulatory frameworks and issues, Europe & Australia

- **EU CCS Directive**
  - Regulatory framework for CO$_2$ storage in geological formations.
  - Enhanced oil recovery not covered.
  - Liability transfer to occur 20+ years after cessation of injection.
  - Sleipner and Snohvit permitted by petroleum regulation, but need to comply with elements of Norwegian transposition of Directive.

- **Australia:**
  - Offshore Greenhouse Gas Storage Bill – amendment to petroleum regulation that gives right-of-way to petroleum activities.
  - Victoria: Regulations passed to enable Otway pilot project.
Regulatory frameworks and issues, North America

**U.S.**
- A new well class (UIC Class VI) introduced for CO$_2$ geologic sequestration
- Includes extensive requirements to site characterization, well construction, monitoring and post-injection site care
- Stipulates a post-injection site care period of 50 years
- Does not address pore-space ownership

**Canada:**
- Federal:
  - CO$_2$-emission performance standard for power plants (July 2015).
  - Forces coal fired power plants to implement CCS
- Alberta:
  - Bill 24: The crown owns the pore space, province accepts long term liability
  - Sequestration Tenure Regulation: Scheme for granting of sequestration leases
OSPAR Convention

- Marine Convention for NE Atlantic

- Amendments to allow CO$_2$ storage ratified in 2011

- Requirement to follow OSPAR guidelines for risk assessment and management of storage of CO$_2$ in sub-seafloor geological formations.