



Lessons from the London Protocol

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2023 Joint Annual GoMCarb – SECARB Offshore Partnerships' Meeting
UT at Austin, 5 April 2023



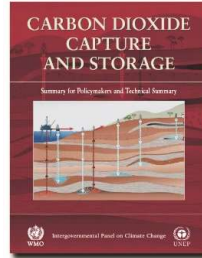
Who are we?

Our internationally recognised name is the IEA Greenhouse Gas R&D Programme (IEAGHG). We are a Technology Collaboration Programme (TCP) and are a part of the International Energy Agency's (IEA's) Energy Technology Network.

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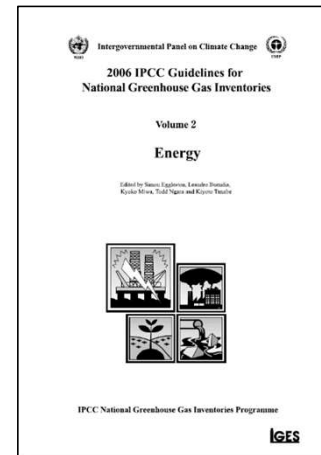
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IPCC Special Report on CCS (2005)



- “Observations from engineered and natural analogues as well as models suggest that the fraction retained in appropriately selected and managed geological reservoirs is very likely to exceed 99% over 100 years and is likely to exceed 99% over 1,000 years. ”
- “For well-selected, designed and managed sites, the vast majority of the CO₂ will gradually be immobilized by various trapping mechanisms and, in that case, could be retained for up to millions of years. Storage could become more secure over longer timescales. ”

IPCC Guidelines for GHG Inventories (2006)



Vol 2 Energy, Chp 5 - CO₂ Transport, Injection and Geological Storage

- Each site will have different characteristics, hence a site-specific Tier 3 approach:
- Methodology:

Site characterisation – inc leakage pathways



Assessment of risk of leakage – simulation / modelling of CO₂ plume



Monitoring – monitoring plan on site-specific basis



Reporting – inc CO₂ injected and emissions from storage site

- Supports zero leakage assumption (unless monitoring indicates otherwise)
- Leakage defined as from ground surface or seabed to atmosphere or ocean
- Basis for CCS regulations ie LP, OSPAR, EU CCS Directive, EU ETS, UNFCCC CDM.....

London Convention and London Protocol



- Marine Treaties - Global agreements regulating disposal of wastes and other matter at sea
- London Convention 1972 (87 countries).
- London Protocol 1996 – ratified March 2006 (53 countries as of Oct 2019) is more modern treaty
- Annual Meeting of the Contracted Parties + Annual meeting of Scientific Group.
- Secretariat is the International Maritime Organisation (IMO)



- **London Protocol** – how it works:
- Prohibition on dumping of all wastes, except for those listed in Annex 1, which need to be permitted under conditions in Annex 2.

The dumping of wastes or other matter listed in Annex 1 shall require a permit. Contracting Parties shall adopt administrative or legislative measures to ensure that issuance of permits and permit conditions comply with provisions of Annex 2.

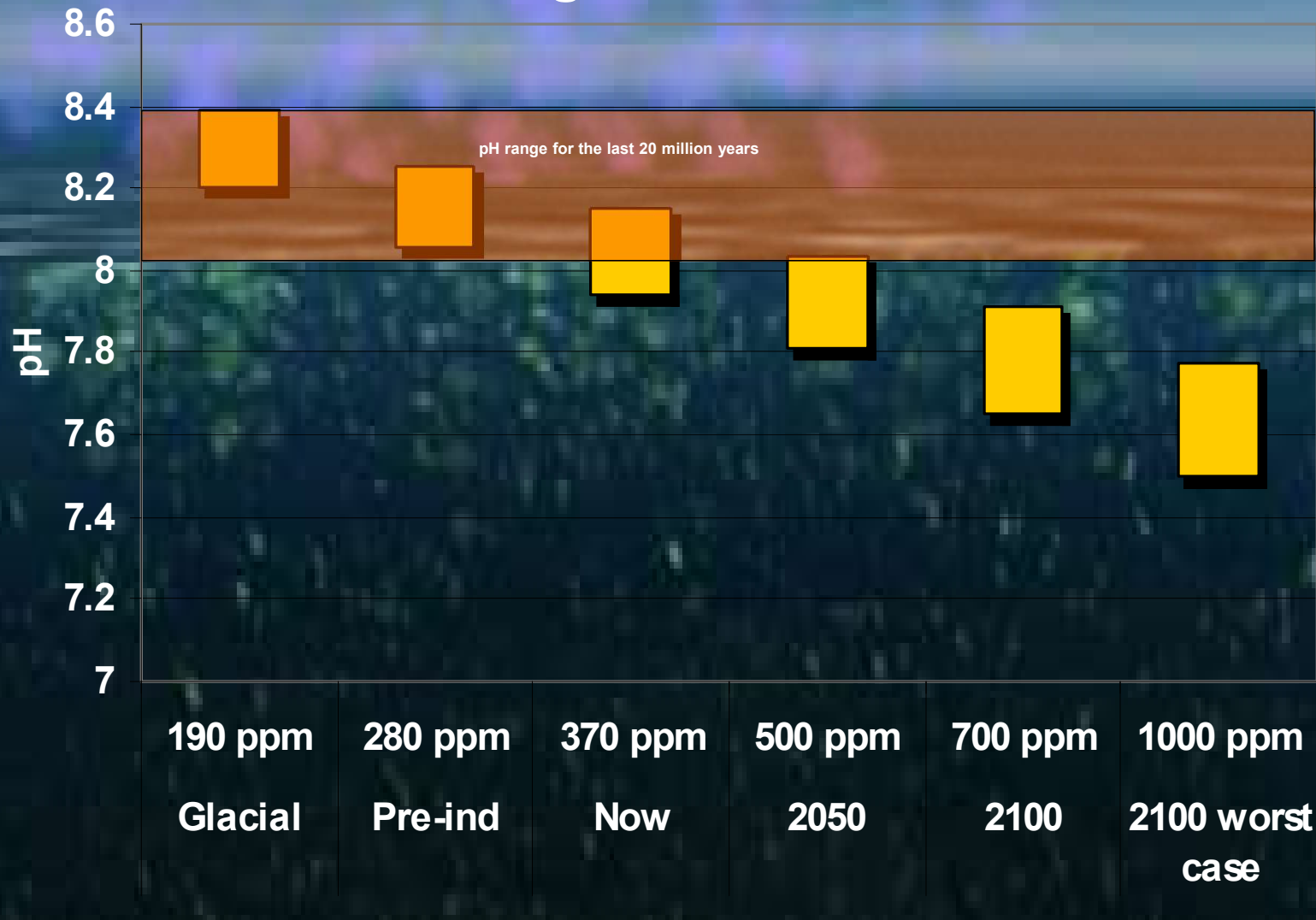
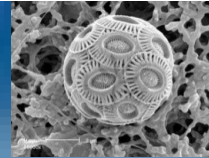
- Annex 1: dredged material; sewage sludge; fish waste; vessels and platforms; inert, inorganic geological material; organic material of natural origin; bulky items primarily comprising unarmful materials from small islands with no access to waste disposal options
- Annex 2: Assessment of wastes or other matter that may be considered for dumping

London Protocol and CCS



- Prohibited some CCS project configurations
- CO₂ Geological Storage Assessed by LC Scientific Group 2005/6
- Produced "Risk Assessment and Management Framework for CO₂ " (2006)
- **To allow prohibited CCS configurations – Protocol amendment adopted at 28th Consultative Meeting (LP1), 2 Nov 2006** - came into force 10 Feb 2007 to allow disposal in sub-seabed geological formations
- "CO₂ Specific Guidelines" (2007) - to guide assessment and permitting meeting requirements of LP Annex 2

Simulated and observed marine pH ranges till 2100



PML
2005

London Protocol Amendment



2006 amendments (LP1.(1))

Allowed to dispose of " CO₂ streams from CO₂ capture processes for sequestration"

"Carbon dioxide streams may only be considered for dumping, if:

- 1 disposal is into a sub-seabed geological formation; and*
- 2 they consist **overwhelmingly** of carbon dioxide. They may contain incidental associated substances derived from the source material and the capture and sequestration processes used; and*
- 3 no wastes or other matter are added for the purpose of disposing of those wastes or other matter."*



LP CO₂ Specific Guidelines (2007)

In order to receive a permit must demonstrate:

- CO₂ Stream characterisation (incidental associated substances)
- Site Selection and Characterisation – storage capacity, injectivity, long-term storage integrity, potential migration and leakage pathways, geochemistry, monitoring, mitigation possibilities, operational feasibility
 - Environmental Characterisation and other uses
 - Potential exposure assessment routes
 - Potential exposure effects
 - Risk Assessment
 - Impact Hypothesis
- Monitoring and Risk Management
- Permit Conditions



Draws upon Risk Assessment and Management Framework 2006, which draws upon IPCC SRCCS (2005) and IPCC GHG (2006)



**REVIEW OF PROJECT
PERMITS UNDER THE
LONDON PROTOCOL –
AN ASSESSMENT OF
THE PROPOSED P18-4
CO₂ STORAGE SITE**

Report: 2016/TR4

May 2016



Lessons Learnt

<http://www.ieaghg.org/publications/technical-reports/129-publications/new-reports-list/681-2014-tr4>

CO₂ Specific Guidelines



- Around 56 requirements - generally qualitative rather than quantitative in nature:
 - Waste prevention audit / Waste management options
 - Chemical and physical properties (of CO₂ stream)
 - Action list (substances not allowed in CO₂ stream)
 - Site selection and characterisation
 - Characterization of the sub-seabed geological formation
 - Characterization of the marine area
 - Evaluation of potential exposure
 - Assessment of potential effects
 - Evaluation of potential effects
 - Risk assessment
 - **Impact hypothesis**
 - Monitoring and risk management
 - Monitoring and risk management
 - Mitigation or remediation plan
 - Permit and permit conditions

ROAD Project Storage Site



- P18-4 field - near-depleted gas field located approximately 20 km off the Dutch coast in the North Sea, originally proposed for ROAD project storage.
- Operator applied for a CO₂ storage permit to the Dutch authorities in 2011.
- EC gave positive 'Opinion' in Feb 2012.
- Storage permit for P18-4 was approved in September 2013.

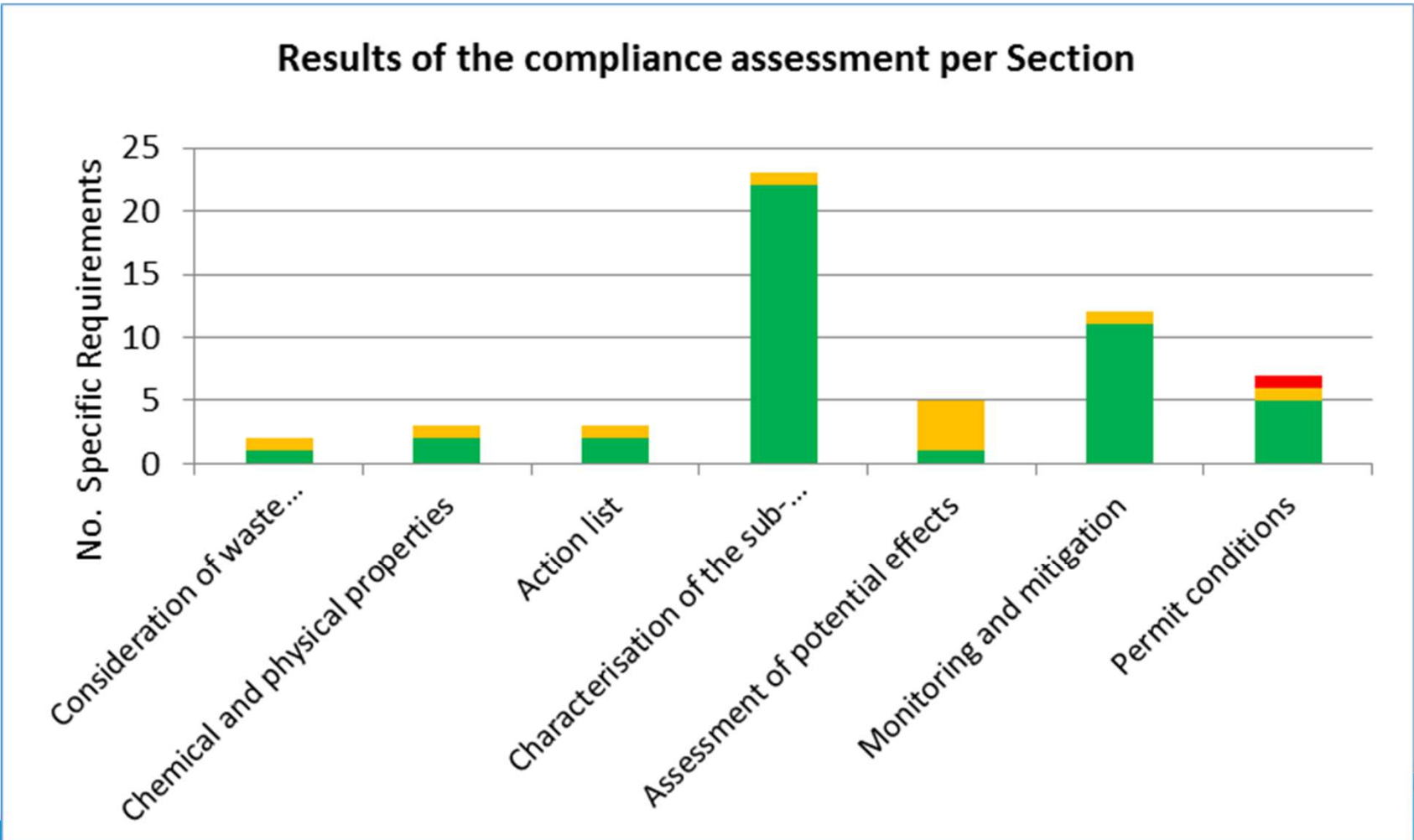


- However the project was postponed indefinitely due to economic constraints.

Scope of Work



- Objective: to assess to what extent the permit application complies with the London Protocol's 2012 Specific Guidelines, and therefore the 1996 London Protocol itself.
- Systematic cross-check of the 56 requirements of the Specific Guidelines against the contents of the application material provided by the operator to the National Authority. Approximately 1100 pages of material (some in Dutch).
- Undertaken by TNO



Compliance – Partial



Para	Specific Guideline requirements	Evaluation
3.2.2	other disposal and/or sequestration options, e.g. land-based underground storage.	
4.2.3	toxicity, persistence, potential for bio-accumulation	
5.2	Development of a screening tool to assess the acceptability of CO ₂ streams for disposal, based on the presence of incidental substances	
6.2.9	economic and operational feasibility	
7.6	Evaluation of potential effects on human health, living resources, amenities and other legitimate uses of the sea.	
7.8.1	Magnitude to which the release increase the concentration of the substance in the seawater, sediments or biota	
7.8.2	The degree to which the substance can produce adverse effects on the marine environment or human health	
7.11	Development of an impact hypothesis	
8.7.4	Monitoring marine communities (benthic and water column) to detect effects of CO ₂ leakage	
9.2	Opportunities are provided for public review and participation	
9.4	Permits should be reviewed at regular intervals	

Recommendations in report



Recommendations to the National Authority

- A brief summary of conformance with the requirements of the 1996 London Protocol to be included in permit conditions.
- Applicant should be asked to provide information on effects of CO₂ leakage on the marine environment. Can be based on the outcomes of the risk assessment and/or from pre-existing information from a similarly indicative area.
- The applicant should be asked explicitly to conclude with an “Impact Hypothesis”
- If it has been decided not to develop an Action List this should be explicitly mentioned as part of the LP compliance summary recommended above.
- The National Authority should ensure that fixed intervals for permit review are explicitly mentioned in the permit conditions.

Recommendations to the London Protocol

- Clarification on the economic and operational feasibility aspects in site-selection .
- Clarification could be sought on the extent and nature of public participation recommended.



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Conclusions:

- Material submitted to National Authority was broadly sufficient to allow compliance assessment
- Compliance assessment indicates overall technical compliance with the CO₂ Specific Guidelines
- Overall, this exercise demonstrated that the requirements of the CO₂ Specific Guidelines are relevant and achievable by national regulators and CCS projects, and that transparency of compliance assessment is possible in ensuring the protection of the marine environment.



Countries looking at Offshore CCS



Parker Medford, BEG, 2020

LP enabling offshore CO₂ Storage Projects



Including:

- Tomakomai (Japan)
- Northern Lights (Norway)
- Porthos (Netherlands)
- Aramis (Netherlands)
- Greensand (Denmark)
- Bifrost (Denmark)
- Pelican/CarbonNet (Australia)
- Deep C Store (Australia)
- Endurance (UK)
- Liverpool Bay (UK)
- Ravenna (Italy)
- Goldeneye (UK)
- Polaris (Norway)
- Poseidon (Norway)



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London Protocol Transboundary

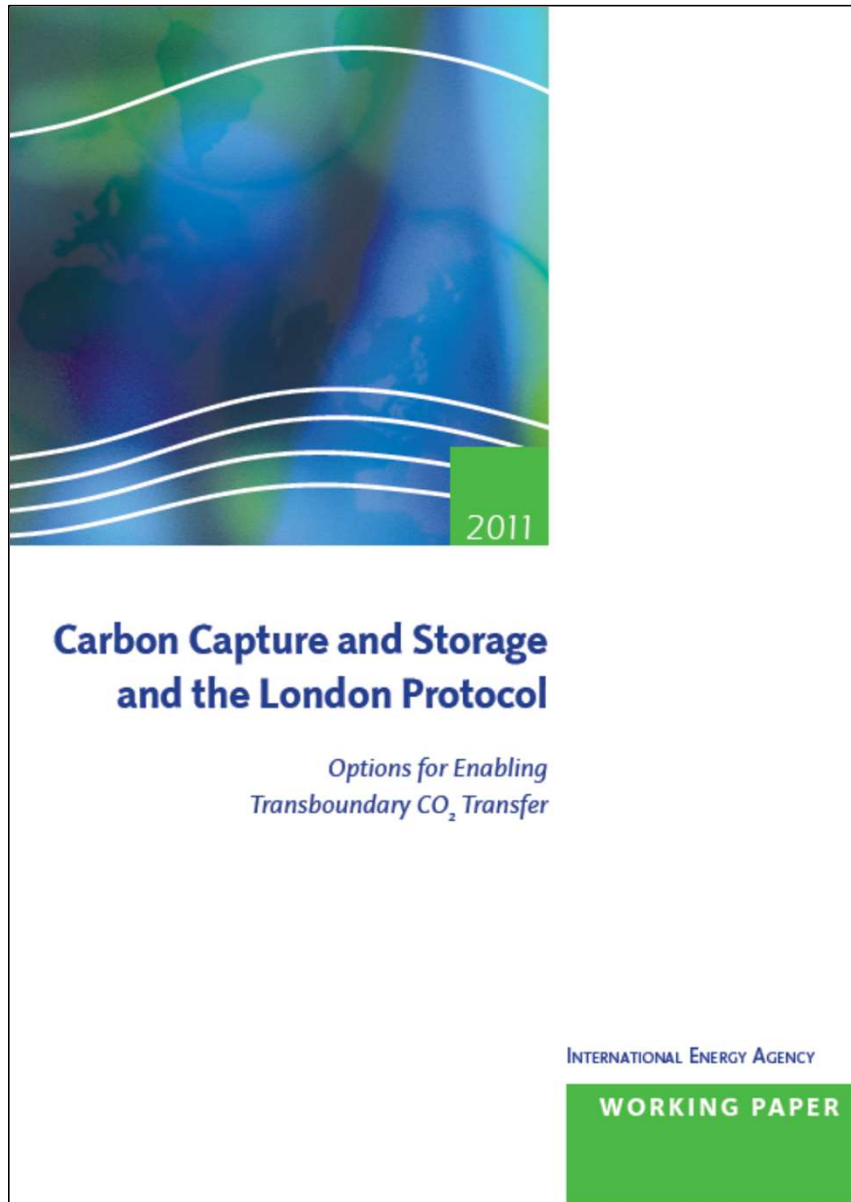


London Protocol Article 6

"EXPORT OF WASTES OR OTHER MATTER

Contracting Parties shall not allow the export of wastes or other matter to other countries for dumping or incineration at sea."

- Prohibits transboundary transport of CO₂ for geological storage
- 2009 LP4 (30 Oct 2009) - Amendment proposed by Norway to allow export of CO₂ for storage was adopted by vote.
- Article 6 , new para 2 : *'Export of CO₂ for disposal in accordance with Annex 1 may occur, provided an agreement or arrangement has been entered into by countries concerned'*
- Agreement shall include : permitting responsibilities; for export to non-LP Parties then provisions equivalent to LP's for issuing permits.
- **But, to come into force needs ratification by acceptance by two thirds all Parties** - Only Norway, UK, Netherlands, Iran, Finland and Estonia accepted in 10 years (Oct 2019)



Options (considering VCLT)

1. Interpretative resolution
2. Provisional application
3. Subsequent agreement through an additional treaty
4. Modification of the operation of relevant aspects of the London Protocol between two or more contracting parties
5. Suspension of the operation of relevant aspects of the London Protocol between two or more contracting parties
6. Conducting CCS through non-contracting parties

IEA 2011

London Protocol CO₂ Export



- LC41 and LP14 meeting at IMO London, 7th-11th October 2019
- **Netherlands and Norway proposal to LP14 for “Provisional Application” of export amendment.**
- Drafting Group formed at LP14.
- IEAGHG supported with Information Paper 2019-IP11, and evidence-base in plenary with paper LC41/INF3
- **Success! – Resolution for Provisional Application adopted 11 Oct 2019**



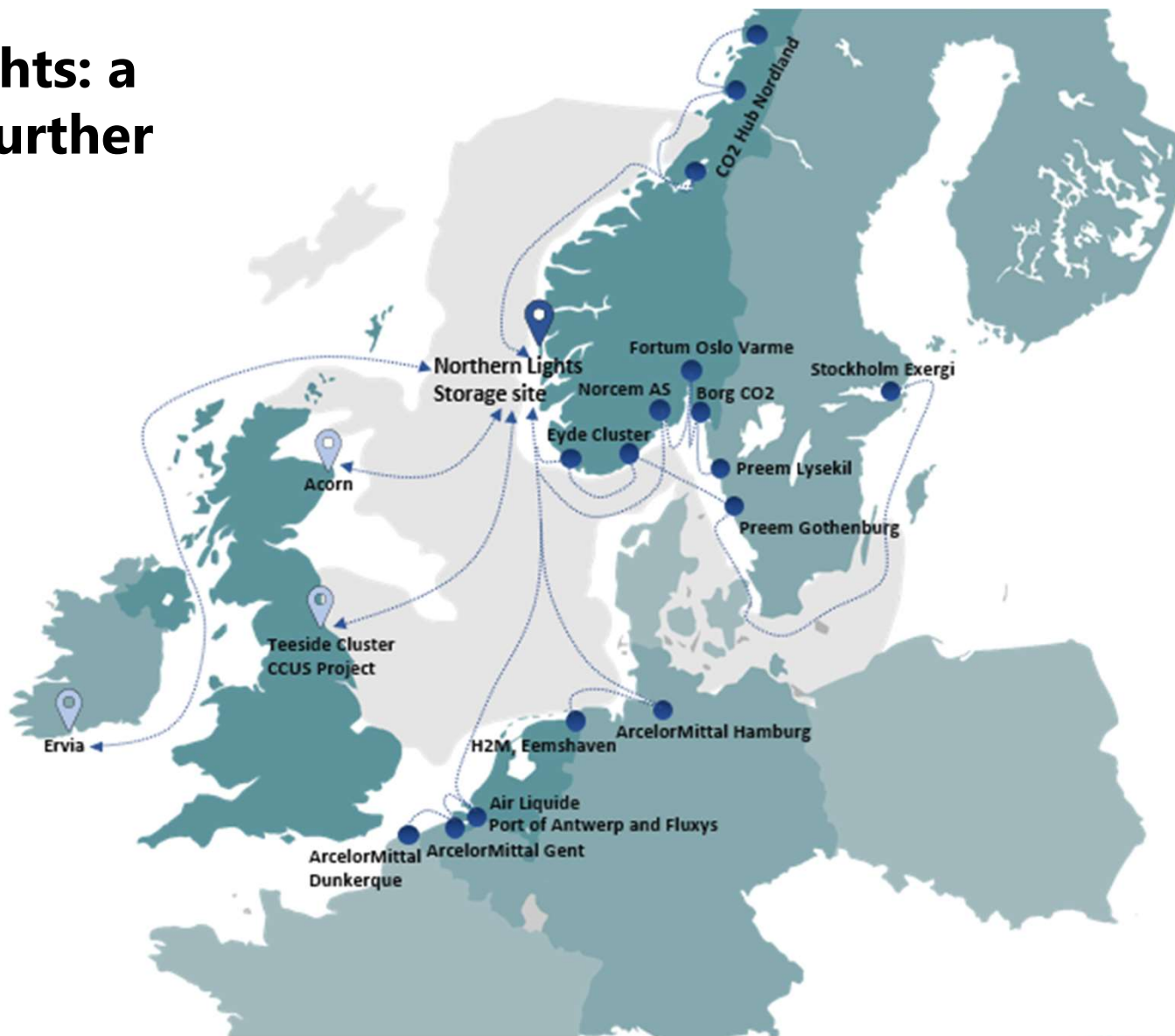
Export of CO₂ for Offshore Storage is Allowed



- This means that countries can now legally export and import CO₂ for offshore geological storage
- Environmental protection is in place. The guidance documents for permitting offshore storage and for export agreements were revised/finalised for transboundary activities in 2012 (CO₂ Specific Guidelines) and 2013 (Agreements and Arrangements).



Northern Lights: a nucleus for further growth



Kilde: PCI-søknad fra Northern Lights (Equinor, Shell og Total)

Resolution LP.5(14) on the Provisional Application of the 2009 Amendment to Article 6 of the London Protocol (2019)



Update :-

- Declarations of Provisional Application received by IMO from: **Norway, Netherlands, Denmark, Korea, Belgium** (Oct 2022)
- "Agreements or Arrangements" (as needed by the 2009 Export Amendment) received by IMO: Denmark-Belgium MoU (Sep 2022)
- **2009 Export amendment needs acceptance by two thirds all Parties ie 36/53**
- Norway, UK, Netherlands, Iran, Finland, Estonia, Korea, Sweden, Denmark, Belgium = **10 total** (Oct 2022)



- Report describes the background, details and requirements of the provisional application of the CCS export amendment
- Includes the revised “CO₂ Specific Guidelines” (2012)
- Includes the “Guidance on Implementation of Article 6.2 on the Export of CO₂ Streams...” (2013), covering the “Agreements or Arrangements” of responsibilities between Parties



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