Regulatory Factors Overview

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7th International Workshop on Offshore Geologic Storage
Port Arthur, Texas, 17 September 2024

Technology Collaboration Programme
by iea

DISCLAIMER

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.

Disclaimer

The IEA Greenhouse Gas R&D Programme (IEAGHG) is organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. Views, findings and publications of the IEA Greenhouse Gas R&D Programme do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

Knowledge Transfer

Input to WPFE

United Nations Framework Convention on Climate Change

UNFCCC CCS Side Events at COP20, 21, 22, 23, 24, 25, 26, 27, 28

carbon sequestration leadership forum

CSLF Technical Group
IEAGHG inputs

ipcc INTERGOVERNMENTAL PANEL ON climate change

Expert Reviewers, Accredited Observer
AR6 reviews
AR6 – 98 comments provided

CLEAN ENERGY MINISTERIAL
Advancing Clean Energy Together

CCUS Initiative
IEAGHG inputs

Zep Zero emissions platform

IMO

London Convention:
Regular updates on CCS:
ROAD permit assessment, Offshore workshops
CO_2 Export Resolution 2019

ISO TC-265
IEAGHG inputs

ISO

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 (54 countries as of Sep 2023) is the more modern treaty
- Annual Meeting of the Contracted Parties + Annual meeting of Scientific Group.

- 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.

- Annex 1: dredged material; sewage sludge; fish waste; vessels and platforms; inert, inorganic geological material; organic material of natural origin; bulky items primarily comprising unharmful materials, from small islands with no access to waste disposal options

London Protocol and CCS

- Prohibited some CCS project configurations

- CO_2 Geological Storage Assessed by LC Scientific Group 2005/6
- 2006 - Risk Assessment and Management Framework for CO2

- **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

- **CO_2 Specific Guidelines (2007)** - to guide assessment and permitting

London Protocol CO_2 Amendment

2006 amendment (LP1.(1))

Allowed to dispose of " CO_2 streams from CO_2 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."*

LC 28/15 (6 Dec 2006) Annex6

London Protocol – CO_2 Specific Guidelines

”the CO2 stream, consisting of:

1. *CO2;*
2. *incidental associated substances derived from the source material and the capture and sequestration processes used:*
   - *.1 source- and process-derived substances; and*
   - *.2 added substances (i.e. substances added to the CO2 stream to enable or improve the capture and sequestration processes);*

Acceptable concentrations of incidental associated substances should be related to their potential impacts on the integrity of the storage sites and relevant transport infrastructure and the risk they may pose to human health and the marine environment.

LC/SG 30/14 (Jul 2007) Annex 3.

CO_2 Specific Guidelines

- Around 56 requirements - generally qualitative rather than quantitative in nature:
  - Waste prevention audit / Waste management options
  - Chemical and physical properties (of CO_2 stream)
  - **Action List (substances not allowed in CO_2 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

LC Correspondence Group on Experiences with CO_2 Specific Guidelines (1)

Led by Japan and Australia, 2022-2023.

Surveys of London Convention/Protocol countries – 18 countries responded

Questions on:

- National regulations?
- CCS projects?
- Export/import agreements?
- Alternatives to offshore dumping?
- national Action List / “overwhelmingly”?
- Multiple CO2 sources?
- Cross-border storage?
- Regulations on pore space ownership?
- Site characterisation?
- Liability?
- Regulations on wells?
- Risks of Induced Seismicity?
- Monitoring frequency?
- Monitoring for potential leaks?
- Public consultation?
- Permitting period and reviews?
- Alternatives to saline formations?
- Interaction between storage and EOR?
- Other issues not covered in Guidelines?

(LC/SG 47/4, 12 January 2024)

London Convention/Protocol Scientific Group meeting SG47

London, 15-19 April 2024

CCS

- Update from Correspondence Group, led by Japan and Australia, on sharing offshore permitting experiences using the CO_2 Specific Guidelines (2012).
- Greenpeace and ACOPS concerns about CCS used instead of reducing emissions and lack of experience with aspects of CCS including monitoring for leaks
- IEAGHG provided an update, including on 6th Offshore Workshop, and addressed concerns.
- SG47 Science Day on 18 April on CCS Permitting experiences. IEAGHG presented Scene-setter and global updates on offshore CCS.

Marine Geoengineering

- Lots of activity and concerns – prohibition except for research which is permitted under London Protocol

LC Scientific Group SG47 Science Day on CO_2 Permitting (1)

18 April, IMO, London

Agenda (Chaired by South Africa and Korea)

- London Protocol Background – IMO
- Scene-setting CCS Offshore – Tim Dixon IEAGHG
- Australia's draft regs – CSIRO
- USA Offshore Storage Assessment – BOEM
- Ship design – ABS
- Italy regs and first project – ISPRA
- Korea regs – Kongui Nat Uni
- Norway update – Min Climate and Env
- Japan update – Min Env

LC Scientific Group SG47 Science Day on CO_2 Permitting (2)

Questions and concerns from Greenpeace:

- Exporters and Importers – who responsible for CO_2 stream composition?
- Limiting CO_2 to from hard-to-abate sectors
- Divergences on “Overwhelmingly”
- No experiences with multiple sources
- Some countries not monitoring leakage pathways
- No experience with assessing risks of induced seismicity
- Not much experience in monitoring for leaks, nor confidence in techniques
- Permit review providing opportunity to reduce disposal at sea
- How ensure CO_2-EOR does not result in double-standards of regulation, or expansion of fossil fuel extraction?

- (LC/SG 47/WP.5 18 April 2024)

LC Correspondence Group on Experiences with CO_2 Specific Guidelines (2)

- SG47 Decided to continue Correspondence Group to work intersessionally to collect further information including on the questions raised, and produce final report to Scientific Group in 2025
- Led by Japan and Australia
  - (LC/SG 47/WP.5 18 April 2024)

- IEAGHG can address Greenpeace and others' concerns in the 7th Offshore CCS Workshop and in IEAGHG's Monitoring and Risk Networks (as we did for CCS in the UNFCCC Clean Development Mechanism) and input to the LC Correspondence Group

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 CO_2 for geological storage**

- **2009 LP4 (30 Oct 2009) - Amendment proposed by Norway to allow export of CO_2 for storage was adopted by vote.**

- Article 6 , new para 2 : '**Export of CO_2 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)

London Protocol CO_2 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**

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

Approved on 11 October 2019 . 2 pages of preamble then the operative clauses as follows:

- *1. **DECIDES to allow for the provisional application of the 2009 amendment pending its entry into force by those Contracting Parties which have deposited a declaration on provisional application of the 2009 amendment;***
- *2. INVITES Contracting Parties to deposit with the Depositary a declaration on provisional application of the 2009 amendment of the London Protocol pending its entry into force;*
- *3. FURTHER RECALLS the obligation to notify the Depositary of agreements or arrangements mentioned in article 6, paragraph 2 of the London Protocol (as amended by resolution LP.3(4));*
- *4. AFFIRMS that the export of carbon dioxide under the provisional application of article 6 of the London Protocol (as amended by resolution LP.3(4)), and in compliance with the requirements of paragraph 2 of the article (as amended by resolution LP.3(4)) will not be in breach of article 6 as in force at the time of the export; and*
- *5. URGES Contracting Parties to consider accepting the amendment to article 6 of the London Protocol adopted through resolution LP.3(4).*

London Protocol Transboundary Guidance

CO_2 Specific Guidelines - revised 1 Nov 2012 for transboundary

1.10 In the case of transboundary sub-seabed geological formations that could be used by more than one country or where sub-seabed geological formations are located in areas where there is the potential for transboundary movement of CO_2 streams after injection **the Contracting Party where the injection occurs should be responsible for the implementation of these Specific Guidelines.**

London Protocol Transboundary Guidance

Arrangements or Agreements for Export (2013) - 1

"**Guidance on the Implementation of Article 6.2 on the Export of CO_2 Streams for Disposal in Sub-seabed Geological Formations for the purpose of Sequestration**" . LC 35/15 Annex 6. 2013

- This new Guidance was adopted at the Annual Meeting on 18 October 2013, for use when the export amendment comes into force.
- "*Export of CO2 ….provided an agreement or arrangement has been entered into by countries concerned*"
- Definitions: "agreement" as a legally binding agreement between States, whereas an "arrangement" between refers to something non-binding, such as a memorandum of understanding"
- Allocation of permitting responsibilities between exporting and receiving countries must be confirmed in advance of export, and notified to the IMO.

London Protocol Transboundary Guidance

Arrangements or Agreements for Export - 2

"**Guidance on the Implementation of Article 6.2 on the Export of CO_2 Streams for Disposal in Sub-seabed Geological Formations for the purpose of Sequestration**" . LC 35/15 Annex 6. 2013

- Both Parties have to issue permits to meet LP requirements
- Exporting Party to characterize CO_2 stream and share data with receiving Party
- Receiving Party to characterize storage site, assess potential effects, verify monitoring and risk management, and share data with receiving Party
- *"flexibility given between the two States as to the content of their agreement or arrangement, it must be consistent with both the Protocol's provisions and those of applicable international law"*
- *"The optimal roles and responsibilities may become apparent as practical situations are negotiated over time, including which information is best supplied by which party to the transaction. Furthermore, it is likely that developing a final agreement or arrangement will involve a good deal of back and forth cooperation between two Contracting Parties"*

London Protocol Transboundary Guidance

Arrangements or Agreements for Export - 3

"**Guidance on the Implementation of Article 6.2 on the Export of CO_2 Streams for Disposal in Sub-seabed Geological Formations for the purpose of Sequestration**" . LC 35/15 Annex 6. 2013

- Exports to non-Contracting Parties - full responsibility of the Contracting Party to ensure ***"that the provisions of the agreement or arrangement must at a minimum be equivalent to those contained in the Protocol – including those relating to the issuing of permits and permit condition"*** . This is the means of ensuring the same level of environmental protection is provided for a non-Party storing a Party's CO_2.
- In the case of a breach of an agreement or arrangement by a non-Contracting Party, the Contracting Party should ***"engage in consultations to rectify"*** . In the case of a ***"significant ongoing breach"*** the Contracting Party is required to "***terminate the export"***

- Report describes the background, details and requirements of the provisional application of the CCS export amendment
- Includes the revised "CO_2 Specific Guidelines" (2012)
- Includes the "Guidance on Implementation of Article 6.2 on the Export of CO_2 Streams…." (2013), covering the "Agreements or Arrangements" of responsibilities between Parties

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 (Apr 2024) from **Norway, Netherlands, Denmark, Korea, Belgium, Sweden, UK, Switzerland**
- "Agreements or Arrangements" (as needed by the 2009 Export Amendment) :-1st Arrangement received by IMO: Denmark-Belgium MoU (Sep 2022)
- **European Commission Analysis paper – CCS Directive acts as an "Arrangement"**
- First export – Belgium to Denmark for Greensands test injection (early 2023)
- In 2024 Arrangements by Denmark-France MoU, Netherlands-Norway MoU

- 2009 Export amendment needs acceptance by two thirds all Parties ie

MEMORANDUM OF UNDERSTANDING (MoU)
BETWEEN
THE MINISTER FOR ENVIRONMENT OF THE FLEMISH REGION
AND
THE FEDERAL MINISTER FOR THE NORTH SEA OF BELGIUM
AND
THE MINISTER FOR CLIMATE, ENERGY AND UTILITIES OF DENMARK
ON CROSS BORDER TRANSPORTATION OF CO2 WITH THE PURPOSE OF PERMANENT GEOLOGICAL STORAGE

The Minister for Environment of the Flemish Region, the Federal Minister for the North Sea of Belgium, and the Minister for Climate, Energy and Utilities of Denmark (hereinafter referred to individually as a "Participant" and collectively as the "Participants");

Bearing in mind the MoU between the Participants on cooperation on carbon capture utilisation and storage (CCUS), particularly section 2b on the intent of the Participants to consider and prepare a bilateral agreement or arrangement between the Participants enabling cross-border transportation and storage of CO_2;

Have reached the following understanding:

Section 1 – Scope

This MoU is an arrangement in the sense of Article 6 paragraph 2 of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, as amended by Resolution LP. 3(4). Any definitions used should be understood as they are understood in the context of the London Protocol and applicable European Union law.

This MoU applies to cross border transportation of CO_2 between the Participants with the purpose of permanent geological storage.

Section 2 – Allocation of permits

The Participants recognise that all necessary permit responsibilities will be allocated to the relevant authorities of each Participant's country in accordance with the London Protocol. A non-exhaustive list of relevant permitting authorities are as follows;

For Denmark:

- The Danish Energy Agency (Energistyrelsen) is responsible for the issuance of CO_2 storage permits as well as ETS permits:

Danish Energy Agency (Energistyrelsen)
Carsten Niebuhrs Gade 43
1577 København V

Tlf: 33 92 67 00
ens@ens.dk

Danish Energy Agency (Energistyrelsen), Esbjerg
Niels Bohrs Vej 8D
6700 Esbjerg

Tlf: 33 92 67 00
ens@ens.dk

For Belgium:

- Provincial Executive(s) of the Provincial Council(s) are responsible for the issuance of (amongst other) ETS permits. ETS permits are issued based on an obligatory advice issued by the Flemish Energy and Climate Agency (Vlaams Energie- en Klimaatagentschap), which is also responsible for the implementation of ETS.

  Flemish Energy and Climate Agency (Vlaams Energie- en Klimaatagentschap)
  Koning Albert II-laan 20, box 17
  1000 Brussels

  Tlf 32 2 553 46 00
  veka@vlaanderen.be

- The Flemish government is responsible for the issuance of CO_2 storage permits.

- The Belgian federal maritime authorities are responsible for determining the technical rules and regulations a seagoing vessel has to comply with when shipping CO_2.

Section 3 – Arrangements of the Participants

This MoU does not create any rights and obligations under international law and does not impose any financial obligations on the Participants.

Each Participant intends to conduct the cooperation under this MoU subject to all applicable laws and regulations.

Section 4 – Amendment procedures and mutual understanding

This MoU may be amended at any time by jointly written consent of the Participants.

At any time, the Participants will consult, at the request of any of them, on any matter relating to this MoU, in the spirit of cooperation, good faith and mutual trust, to resolve quickly any difficulties or misunderstanding that may arise.

The Participants will convene to evaluate the MoU at least once a year, unless they decide not to convene by jointly written consent. The Participants will convene alternatively in Copenhagen and Brussels, or in any other place decided upon by the Participants by jointly written consent.

Section 5 – Final provisions

This MoU will come into effect upon signature and upon the date of entry into force of the declaration of provisional application of the 2009 Amendment, in accordance with the national rules of both Participants.

This MoU may be terminated by either Participant giving twelve (12) month's written notice to the other Participant. The termination of this MoU will not affect any on-going activities under this MoU, unless otherwise decided by the Participants.

Signed in duplicate in Copenhagen and Brussels on the 26th of September 2022 each in the English language.

For the Flemish Region:

The Minister of Justice and Enforcement, Environment, Energy and Tourism

Zuhal Demir

The Minister for Climate, Energy and Utilities of Denmark

Dan Jørgensen

For the Federal Government:

The Minister of the North Sea

Vincent Van Quickenborne

IPCC Guidelines for GHG Inventories

- Apr 2006
- Vol 2 Energy, Chp 5 - CO2 Transport, Injection and Geological Storage
- Each site will have different characteristics
- Methodology

  Site characterisation – inc leakage pathways

  ↓

  Assessment of risk of leakage – simulation / modelling

  ↓ ↑

  Monitoring – monitoring plan

  ↓

  Reporting – inc CO2 inj and emissions from storage site
- For appropriately selected and managed sites, supports zero leakage assumption unless monitoring indicates otherwise

IPCC Guidelines for GHG Inventories

Reporting of cross-border CCS operations - 4 scenarios:

Scenario 1. CO2 may be captured in one country, Country A, and exported for storage in a different country, Country B.

Country A should report the amount of CO2 captured, any emissions from transport and/or temporary storage that takes place in Country A, and the amount of CO2 exported to Country B.

Country B should report the amount of CO2 imported, any emissions from transport and/or temporary storage (that takes place in Country B), and any emissions from injection and geological storage sites.

IPCC Guidelines for GHG Inventories

Reporting of cross-border CCS operations - 4 scenarios:

Scenario 2. CO2 is injected in one country, Country A, and migrates from the storage site and leaks in a different country, Country B.

Country A is responsible for reporting the emissions from the geological storage site. If such leakage is anticipated based on site characterization and modelling, Country A should make an arrangement with Country B to ensure that appropriate standards for long-term storage and monitoring and/or estimation of emissions are applied.

IPCC Guidelines for GHG Inventories

Reporting of cross-border CCS operations - 4 scenarios:

Scenario 3. More than one country utilizes a common storage site.

The country where the geological storage takes place is responsible for reporting emissions from that site. If the emissions occur outside of that country, they are still responsible for reporting those emissions

IPCC Guidelines for GHG Inventories

Reporting of cross-border CCS operations - 4 scenarios:

Scenario 4. Storage site occurs in more than one country.

Countries concerned should make an arrangement whereby each reports an agreed fraction of the total emissions.

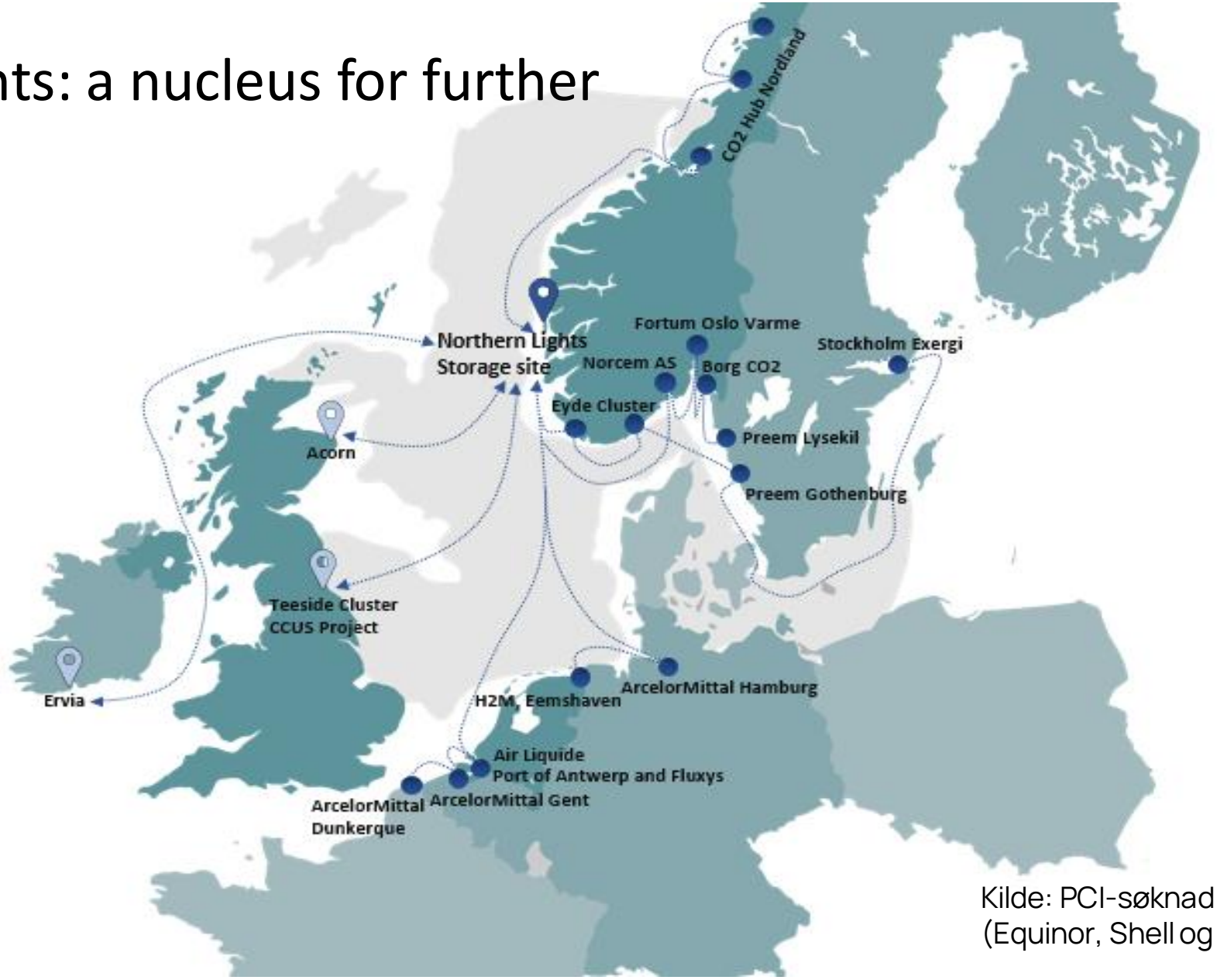
COP26 Glasgow

Paris Agreement Article 6 – International Cooperation

- Article 6.2 relates to emissions trading between countries (ITMOs and OIMPs)
  - operationalised via bilateral agreements between countries

- Article 6.4 creates a new project-orientated emission crediting mechanism (like a new CDM)
  - not operationalised – Supervisory Body revisiting Removals, may merge with standard methodology

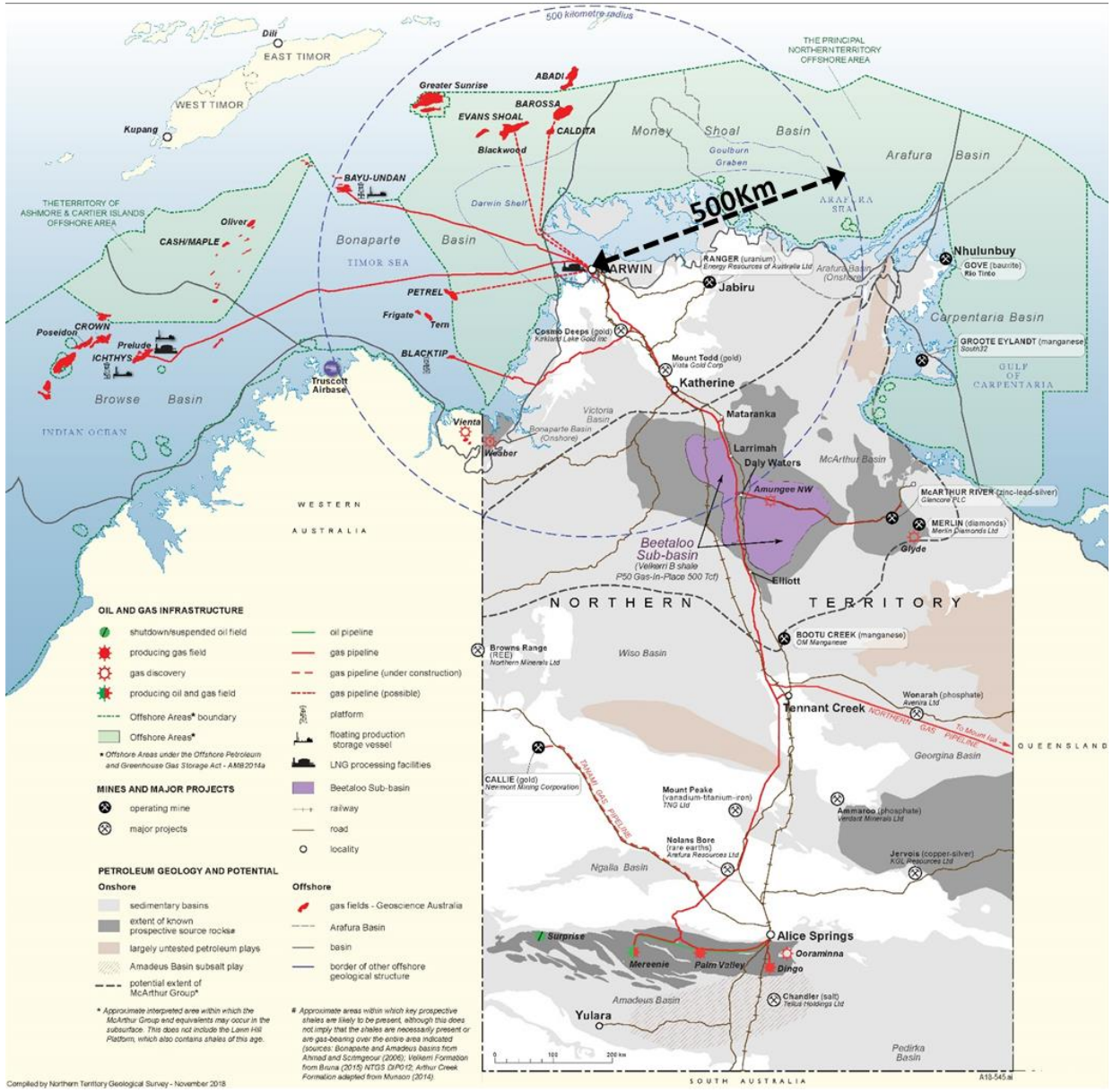
Northern Lights: a nucleus for further growth



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

Bayu-Undan field and potential storage overview

- BU gas condensate field:
  - Location: Offshore Timor-Leste
  - Water depth: 80-100 m
  - Operator: SANTOS LTD (and TIMOR GAP from 2024)
  - Discovery: 1995
  - Start Production: 2004
  - Expected end-of-field life: 2025



Acknowledgements to N.Dos.Reis (TL) and H.Smith (NT)

Useful information sources and references

For London Protocol： Carbon Capture and Sequestration (imo.org)

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Dixon, T, Havercroft, I. and McCoy, S. *Legal and Regulatory Developments on CCS.* International Journal of Greenhouse Gas Control 40 (2015) 431–448 (IPCC SR Special Issue)

Dixon, T, et al. *International Marine Regulation of CO2 Geological Storage*. Elsevier Energy Procedia 1 (2009) 4503-4510

ANGEA carbon accreditation study

SEACA III Workshop - 27-28 August, Kuala Lumpur (GCCSI)

Thank You

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