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House of Representatives Standing Committee on Climate Change, Energy, Environment and Water

Inquiry into the 2009 and 2013 amendments to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Protocol)

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The Global CCS Institute welcomes the opportunity to provide a submission in response to the Committee's inquiry into the 2009 and 2013 amendments to the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Protocol).

About the Global CCS Institute

The Global CCS Institute is an international think tank with a mission to accelerate the deployment of carbon capture and storage (CCS), a vital technology to tackle climate change and deliver climate neutrality. With a team of professionals working with and on behalf of its Members, the Institute shares expertise, builds capacity and provides advice and support with the aim of driving the adoption of CCS as quickly and cost effectively as possible so that this vital technology can play its part in reducing greenhouse gas emissions.

The Institute is headquartered in Melbourne, Australia, with offices in Washington DC, Brussels, Beijing, London, Tokyo and Abu Dhabi.

CCS and its role in mitigating climate change

CCS is a proven technology that can deliver deep emissions reductions from hard-to-abate, emissions-intensive industries and industrial processes. The technology involves capturing CO_2 emissions from large industrial plants such as steel mills, cement plants, coal and natural gas fired-power plants, and refineries, compressing it for transportation and then injecting it deep underground into a carefully selected and safe geological storage site, where it is permanently stored. There are currently 32 operational CCS facilities around the world capturing up to 40Mtpa of CO_2 [1] .

Several studies such as the IPCC 1.5°C Special Report and by the International Energy Agency have consistently highlighted the critical role of CCS in facilitating the global transition to a net zero emissions economy. The IPCC states that CCS will need to store an average of 600 gigatonnes (Gt) of CO_2 this century to achieve the global climate targets of the Paris Agreement [2]. Three out of the four pathways modelled by the IPCC for limiting temperatures to 1.5 degrees by 2050 incorporate a significant role for CCS and require its widespread adoption [3].

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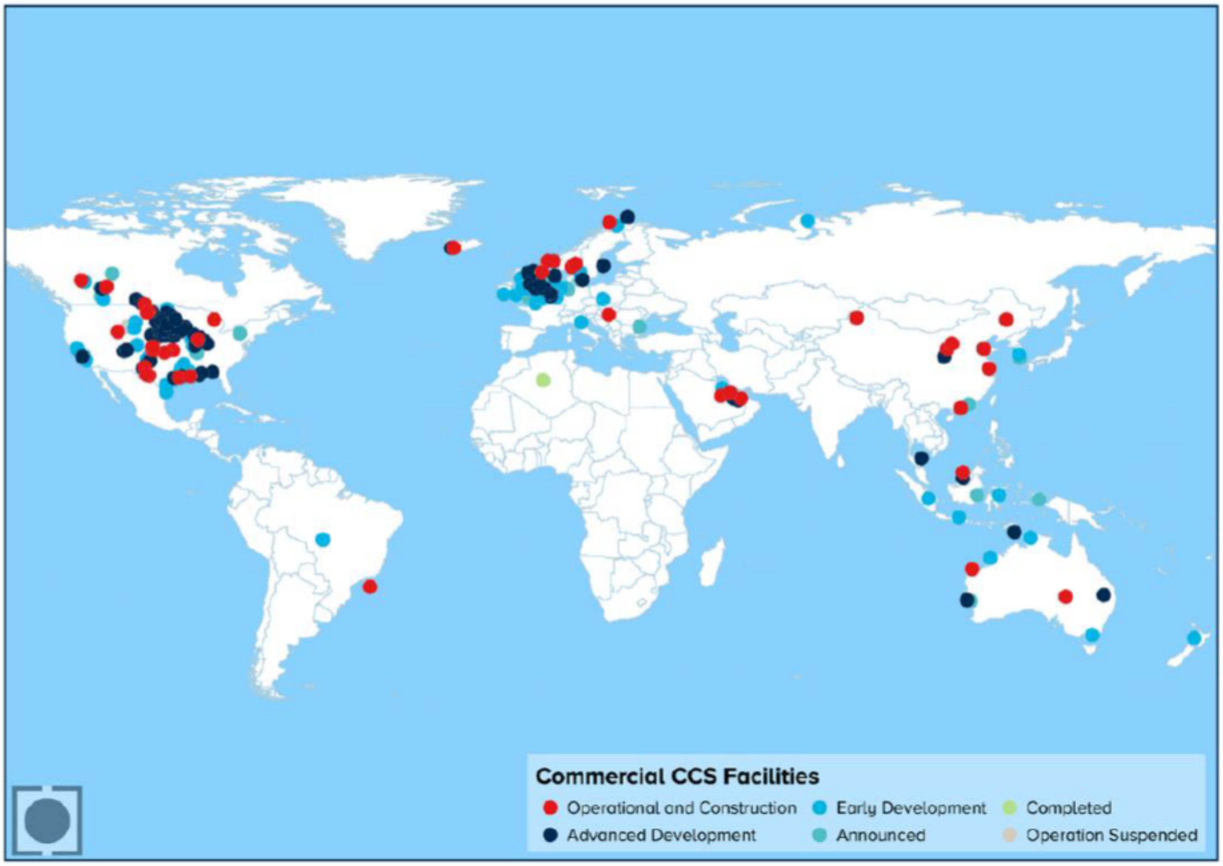
Figure 1 World map of CCS facilities at various stages of development



The role of offshore CO_2 storage

Geologic storage reservoirs for the injection and permanent storage of CO_2 may be located onshore or offshore in the deep sub-seabed. However, a key risk facing many emissions-intensive economies around the world seeking to deploy CCS technologies is the lack of suitable onshore storage capacity within their territories. As a consequence, CCS project proponents are increasingly exploring the option of offshore sub-seabed CO_2 storage.

Although generally considered a more expensive option, there are several advantages of offshore sub-seabed CO_2 storage. These include:

- ample high-quality storage capacity,
- the geologic characteristics of subsurface storage reservoirs are well-understood due to previous oil and gas exploration and production activities,
- clarity of ownership (the state being the owner of sub-seabed reservoirs),
- the lack of neighbouring residents and communities,
- pre-existence of pipeline and other injection/production infrastructure and
- ease of conducting monitoring activities offshore

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Australia's Offshore CO_2 storage potential

Australia's offshore sedimentary basins are world-class for CO_2 storage, with abundant resources creating the opportunity for a new international CO_2 transport and storage industry. This statement is based on almost 30 years of analysis from Geoscience Australia and is backed by industry. The Carbon Storage Taskforce (2009) stated that the offshore basins in Western Australia and the Northern Territory were 'highly suitable' for CO_2 storage (Figure 2). The offshore portion of the Gippsland Basin, underlying the Bass Strait off Victoria, was identified as having the highest suitability for storage in Australia, according to the Taskforce. Their analysis is backed by a wealth of geological data and, in the Gippsland Basin's case, a CO_2 storage appraisal well [4]. For these reasons, the Australian Government released greenhouse gas permits in most of these highly suitable basins – they offer the highest chance of success for a CO_2 transport and storage facility to operate soon.

Those storage basins also have significant resource potential with numerous large, depleted fields due to decades of hydrocarbon production. In addition, the saline formations around these fields are orders of magnitude greater than the depleted fields, with capacities of up to 50,000 million tonnes of carbon dioxide storage in the Carnarvon Basin alone. In context, Australia's current emissions are 480 million tonnes. These storage resources have access to legacy oil and gas infrastructure to build a new industry.

Today, the LNG industry provides a track record of exploiting Australia's abundant gas resources and transporting those gases internationally. The co-location of abundant storage resources and existing infrastructure makes the north and northwest shelf of Australia, in particular, an attractive potential option for the global import of CO_2 through multiple CO_2 transport and storage facilities and creates a significant CCS industry.

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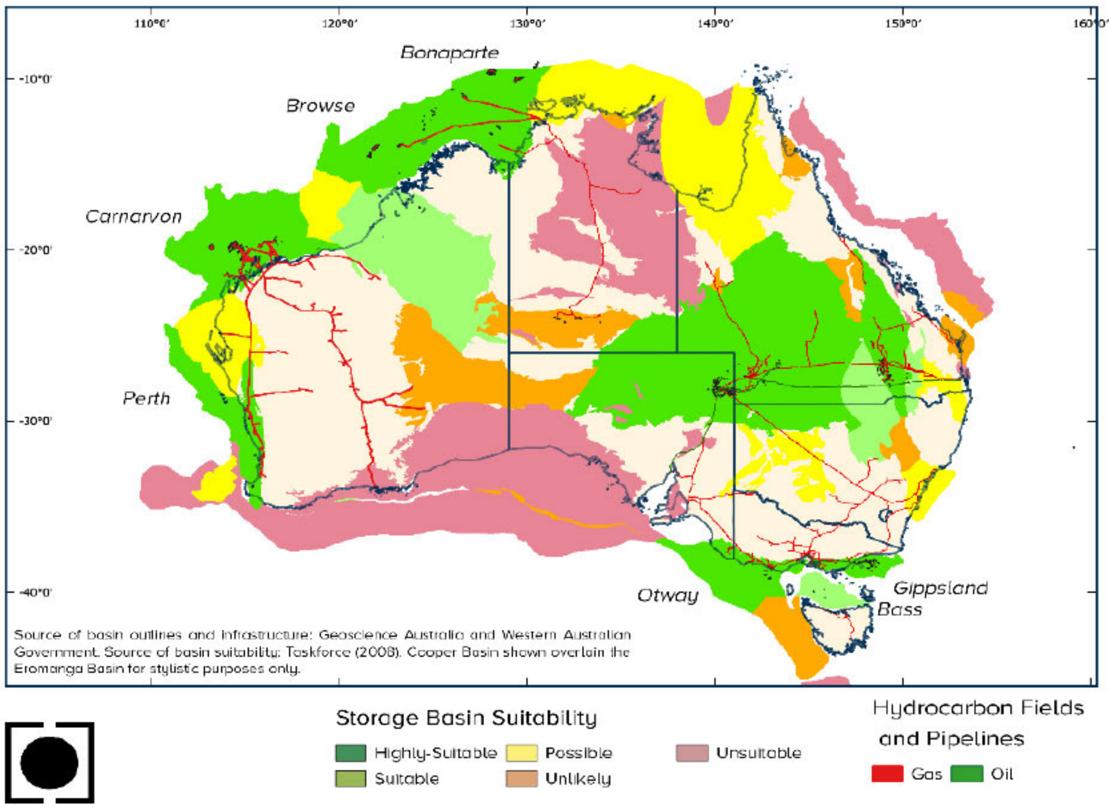
Figure 2 Australian Sedimentary Basins CO_2 storage suitability. Offshore basins ranked as highly suitable, and suitable are labelled. After: Taskforce (2009)



The emerging significance of the import and export of CO_2 streams for sub-seabed sequestration

The promising role of CCS in delivering crucial emissions reductions has led to unprecedented levels of investments in carbon capture and storage (CCS) in recent years, with the pipeline of commercial facilities continuing to grow as the technology becomes increasingly competitive and commercial in many countries (Figure 3). As of February 2023, the capture capacity of CCS projects in the project pipeline is 282 million tonnes per annum (Mtpa). The total capacity of CCS projects that are operating or in development has grown very strongly since 2017, with year-on-year growth of around 40% since 2020[1].

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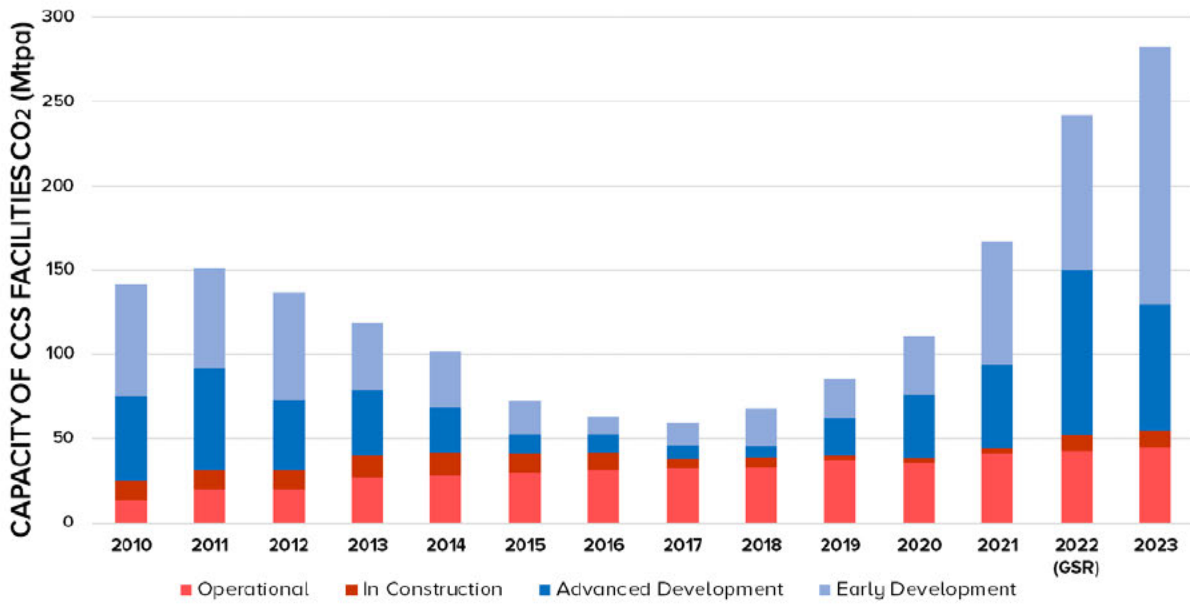
Figure 3 Pipeline of commercial facilities since 2010 by capture capacity (Mtpa) (as of February 2023)[1]



In line with this trend, the emergence of new markets and applications for CCS technologies, enhanced national commitments to achieving net-zero and the commercial opportunities posed by the deployment of CCS networks, has also led to greater scrutiny of CCS project opportunities beyond national boundaries.

The wider transboundary focus has been elevated further by the development of several regional cooperation initiatives aimed at advancing deployment of the technology. In these instances, governments and corporations have adopted a more collaborative approach towards exploring project models that involve the transboundary export and import of CO_2 for storage.

An example is the development of the Northern Lights Project in Norway. In the North Sea, this Norwegian CCS hub aggregates CO_2 streams, beginning with foundation sources from waste-to-energy and cement plants (combined capacity of 0.8 Mtpa of CO_2). Developed by Equinor, Shell and Total, the project will compress and liquefy CO_2 at source plants before transport by dedicated CO_2 ship, to a storage site. The Norwegian government anticipates that projects from European countries, particularly those CCS projects that are affiliated to the EU Projects of Common Interest for CCS, may potentially connect to the storage infrastructure developed under

[1] The decrease in the capacity of the advanced development facilities in 2023 is primarily due to the re-evaluation and consolidation of the individual components of the East Coast Cluster (UK). This chart does not include the following:

- Announced or Operation Suspended Facilities.
- Transport and Storage Facilities unless a capture facility is cited.
- Facilities that have not announced their capacity.

the Northern Lights project. Figure 4 provides an overview of countries and projects affiliated to the EU Projects of Common Interest for CCS **[5]**.

Figure 4 Countries and projects affiliated to the Northern Lights' Projects of Common Interest (Longship Project - White Paper, Norwegian Ministry of Petroleum and Energy)

Similarly, several countries and operators in the Asia Pacific region have already identified individual nations with limited domestic storage potential and are now actively considering the potential for transporting and storing their CO_2 in the territorial waters of other countries within the region.

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The London Protocol and its role in supporting CCS activities

As countries began to explore the option of conducting CCS in the offshore marine environment, legal barriers to these operations found within international marine agreements became the subject of scrutiny. The CCS-specific amendments to the London Protocol of 2006 and 2009, discussed in this section, removed significant international barriers to deployment and have been important in developing wider legal and regulatory support for the technology.

The London Convention of 1972 was the first international agreement to provide protection to the marine environment from the deliberate disposal at sea of wastes, however, it was decided in the 1990s that it required modernisation in the form of the 1996 Protocol. The London Protocol of 1996, which entered into force in 2006, supersedes the Convention for those parties to the Convention which have subsequently become parties to the Protocol [6] [7].

The London Protocol adopts a stringent, precautionary approach to the disposal of wastes, with Parties required to prohibit the dumping of all wastes at sea, save for those listed in the Protocol's Annex. In 2004, negotiations to remove the legal barriers posed by the Protocol to offshore CCS activities began, with the Contracting Parties tasking the Scientific Group with assessing the implications and risks posed by CCS operations towards the marine environment [8].

Following the completion of various CCS-related legal and technical reviews and the entry into force of the Protocol, an amendment to the Protocol was proposed. The amendments to the Protocol's Annex, to allow the storage of CO_2 in sub-seabed geological formations, was proposed by Australia and co-sponsored by France, Norway and the United Kingdom [9]. At the first meeting of the Contracting Parties to the London Protocol in November 2006, a formal resolution was adopted [10].

The amendment entered into force in February 2007 for all Contracting Parties to the Protocol and inserted a new category into the Annex of wastes that may be considered for dumping. This category consists of '*Carbon dioxide streams from carbon dioxide capture processes for sequestration*' and provides a formal basis for the regulation of CO_2 sequestration in sub-seabed geological formations under the Protocol's mechanisms [11].

The 2006 amendment subjected CO_2 storage to a licensing process under Article 4 of the Protocol, under which Parties are required to adopt administrative and legislative measures to ensure that the permitting process for CO_2 storage complies with Annex 2 of the Protocol. Annex 2 sets out conditions for the grant of permits that authorise the disposal of substances, including impact assessments and the establishment of monitoring conditions.

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Transboundary considerations: the 2009 amendment to the London Protocol

As international discussions turned to the potential for transboundary CO_2 export and import, the Parties to the Protocol deliberated an amendment of the Protocol once again. Notwithstanding the adoption of the earlier 2006 amendment, it was determined that the provisions of Article 6, which prohibited "*the export of wastes or other matter to other countries for dumping or incineration at sea*" would similarly prohibit the transboundary transportation of CO_2 for geological storage [12].

Technical studies and discussions between the Protocol's Parties, highlighted a wide range of matters relating to the safety, risks, and environmental implications of transboundary movement. Parties considered the conditions to be applied to transboundary CO_2 transport and whether, as a pre-requisite to conducting such activities, a lack of suitable storage capacity within a party's territory should be a consideration in determining the permissibility of transboundary options. The issues of permitting, reporting and monitoring of transboundary operation, as well as the allocation of responsibilities between States, were also examined. One issue that received considerable focus, was the environmental standards to be applied to these operations, particularly in instances where the transportation of CO_2 to non-Contracting Parties was contemplated [13].

A formal amendment to Article 6 of the Protocol was adopted in October 2009, which would enable transboundary movement of CO_2, for the purpose of subsequent offshore geological storage, provided that "*an agreement or arrangement has been entered into by the countries concerned*". The amendment requires that the agreement includes:

2.1 confirmation and allocation of permitting responsibilities between the exporting and receiving countries, consistent with the provisions of this Protocol and other applicable international law; and

2.2 in the case of export to non-Contracting Parties, provisions at a minimum equivalent to those contained in this Protocol, including those relating to the issuance of permits and permit conditions for complying with the provisions of annex 2, to ensure that the agreement or arrangement does not derogate from the obligations of Contracting Parties under this Protocol to protect and preserve the marine environment. [14]"

To date, however, an insufficient number of Parties have ratified the 2009 amendment to the London Protocol, with two-thirds of the Protocol's Parties required to ratify for the amendment to enter into force for all Parties. As of March 2023, only the governments of Belgium, Denmark, South Korea, Sweden, Norway, United Kingdom, Netherlands, Finland, Estonia, and Iran have ratified the amendment.

In 2019, following a sustained period of impasse, the Parties agreed to the provisional application of the 2009 amendment[15]. The provisional application of the 2009 amendment to Article 6 of the London Protocol enables those countries, who wish to export their CO_2 for storage in another country's territorial waters, to avail themselves of the provisions of the 2009 amendment, in advance of its entry into force. Parties wishing to undertake activities of this nature will be required to provide a declaration of provisional application and notification of any arrangements or agreements to the International Maritime Organisation (IMO). Parties still, however, will be required to meet the standards prescribed by the Protocol.

To date, Norway, the Netherlands, Denmark, Korea, the UK, Belgium and Sweden have deposited declarations announcing the provisional application of the 2009 amendment to the London Protocol within their jurisdictions.

The Institute makes the following observations with regard to the specific issues identified in the Terms of Reference.

The environmental benefits and impacts of exporting and importing carbon dioxide streams for the purpose of sub-seabed sequestration

The unequal distribution of geological storage resources and the rise of closer, regionally focused cooperation in achieving CCS deployment have propelled national governments and corporations around the world to explore CCS project models with a transnational element. Accordingly, the removal of the barrier posed by the London Protocol to such project models, through the adoption of the 2009 amendment, represents a significant milestone.

It is submitted that both the 2006 and 2009 amendments to the London Protocol explicitly recognise and seek to mitigate the environmental risks posed by transboundary CO_2 export and import operations as part of the CCS project value chain. Indeed, prior to the adoption of these key amendments, the environmental implications of such activities in the marine environment have been the subject of rigorous technical reviews and analysis.

The following sections consider the impact of the Protocol's approach to addressing the environmental impacts of transboundary CCS operations.

The 2006 Amendment to the London Protocol: assessment of the environmental impact of offshore CO_2 storage

To ensure a sound regulatory framework, the Contracting Parties formally charged the Scientific Group of the London Protocol with developing and preparing guidelines for assessing CO_2 streams that are to be disposed of in sub-seabed geological formations.

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The Scientific Group's technical analysis and evaluation of the risks and benefits of conducting CCS activities in the marine environment began prior to the adoption of 2006 amendment, with the preparation of the "*Risk Assessment and Management Framework for CO_2 Sequestration in Sub-seabed Geological Structures*" (RAMF) [16].

The RAMF seeks to allow the characterisation of the risks posed by CO_2 sequestration on a site-specific basis; and to also enable the collection of all necessary information for developing a management strategy to 'address uncertainties and any residual risks'. The RAMF is divided into 6 stages as follows:

- Problem Formulation – Scope, potential environmental pathways, boundaries
- Site Characterisation – capacity, integrity, leakage pathways, monitoring options, surrounding area, modelling of CO_2 behaviour.
- Exposure Assessment – properties of the CO_2 stream, exposure processes and pathways, likelihood, scale
- Effects Assessment – Consequences, sensitivity of species, communities, habitats, other users
- Risk Characterisation – integrates exposure and effects, environmental impact, likelihood of adverse impacts
- Risk Management – leak prevention, monitoring of CO_2 streams within and above formations.

The RAMF was carefully considered by the Contracting Parties in the negotiations to enable offshore CO_2 storage under the Protocol and received endorsement at the meeting of the Contracting Parties in November 2006 that led to the adoption of the 2006 amendment. It was agreed at this meeting that the RAMF would provide the basis for developing draft specific guidelines for the assessment of CO_2 sequestration activities in the seabed.

After the adoption of the 2006 amendment, a CO_2 Intersessional Technical Working Group and Correspondence Group established by the Scientific Group prepared guidelines to assist with ensuring that CO_2 sequestration activities are conducted in line with Annex 2 to the London Protocol.

The Specific Guidelines, which were adopted by the Contracting Parties in 2007, are based upon Annex 2 of the Protocol and the broader 1997 generic waste assessment guidelines [12]. In particular, the Specific Guidelines were developed to:

"deal with risks posed by carbon dioxide sequestration in sub-seabed geological formations over all timescales and primarily at the local and regional scale and thus focus on the potential effects on the marine environment in the proximity of the receiving formations."

Accordingly, the Guidelines establish requirements aimed at addressing various environmental risks and impacts associated with the CCS process, including:

- Chemical and physical properties of the CO_2 stream

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- A screening mechanism to determine the presence of incidental associated substances within the CO_2 stream that may potentially impact the integrity of the storage site, relevant transport infrastructure and risks to human health and the marine environment.
- Site selection and characterisation
- Monitoring and Risk Management
- Permit and Permit Conditions

The resolution of the Contracting Parties adopting the 2006 amendment to the Protocol recognises that carbon capture and storage should not be considered a substitute to other measures to reduce CO_2 emissions. However, the resolution acknowledges that CCS is an important interim solution and one of a portfolio of options to reduce atmospheric CO_2 emissions.

The initiative to regulate the activity under the London Protocol in a manner that ensures the protection of the marine environment is a further acknowledgment of the importance and need for offshore CO_2 sequestration in the context of global efforts to combat climate change [11].

The lengthy process that led to the adoption of the 2006 amendment to the London Protocol, in which Australia played a key role, demonstrates that the Contracting Parties were committed, from the outset, to address the environmental impacts of CO_2 sequestration activities in the deep sub-seabed.

Assessment of the environmental implications of the 2009 amendment to the London Protocol

Complementing the safeguards introduced by the 2006 amendment to the London Protocol, the 2009 amendment not only serves to enable the export of CO_2 but also requires parties undertaking CO_2 export to ensure compliance with the level of environmental protection established by the Protocol, regardless of whether the countries are contracting parties to it.

Furthermore, the adoption of the 2009 amendment also led Contracting Parties to request the Scientific Group to re-examine the Specific Guidelines for assessing CO_2 streams for disposal in sub-seabed geological formations to accommodate any necessary adjustments to include specific rules for transboundary CO_2 export activities [14], [17]. This resulted in the development, in 2013, of the Guidance on the implementation of Article 6.2 on the export of carbon dioxide streams for disposal in sub-seabed geological formations for the purpose of sequestration (the Guidance) [18]. The Guidance separates the permitting responsibilities and standards with regard to transboundary export of CO_2 from the Specific Guidelines.

Given the transaction-based nature of CO_2 export agreements or arrangements, the Guidance provides specific information and recommendations that clarify Annex 2 obligations and requirements for export situations in relation to matters such as:

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- CO_2 stream properties
- Disposal site selection and characterisation
- Assessment of the potential effects of storage
- Permits and conditions.

The Guidance sets out the responsibilities of Parties and the requirements of agreements or arrangements, with the objective of maintaining the standards of the London Protocol on permitting offshore storage of CO_2. Contracting Parties are required to ensure that any agreement or arrangement with a non-Contracting Party also complies at a minimum, with the standards established by the Protocol. The Guidance is intended to assist Contracting Parties with implementation once the 2009 amendment enters into force.

The completion of these reviews led to the development of comprehensive guidance on the requirements for permitting and managing the risks associated with projects undertaking the export and offshore storage of CO_2.

The Protocol's requirements also serve as the minimum standard for the national implementation of a permitting framework for CO_2 export and offshore storage projects. States are able to complement these requirements with further conditions and obligations, as needed when establishing domestic regulatory frameworks for enabling such projects. In this respect, the safeguards established under the Protocol presents a significant opportunity for Australia, which possesses well-characterised storage basins and ample storage capacity, to facilitate environmentally safe export and import of CO_2.

The international market for carbon dioxide streams

As the global response to climate change advances from ambition to action, countries have begun to consider the potential for more widespread deployment of CCS technologies. A combination of factors has resulted in a positive international market for CO_2 streams, which in turn, has encouraged the development of transboundary CCS projects.

In Europe, for example, several factors have led to the development of projects with a transboundary project model. A combination of the availability of highly suitable storage within the North Sea, geographical proximity and supportive policy, legal and regulatory regimes across Parties within the region, has resulted in the emergence of several projects.

The Longship project, for example, is a key example of this project model. A multi-phase CCS Network in Norway, the project will involve the transport (via ships and a storage pipeline from a port), injection, and storage of up to 1.5 Mt of CO_2 annually from regional emitters across Europe by 2024. Similar approaches are being developed for projects between Belgium and Denmark.

Several countries and operators across the Asia Pacific region are now identifying the potential for similar models to be adopted. High domestic emissions, limited domestic storage potential

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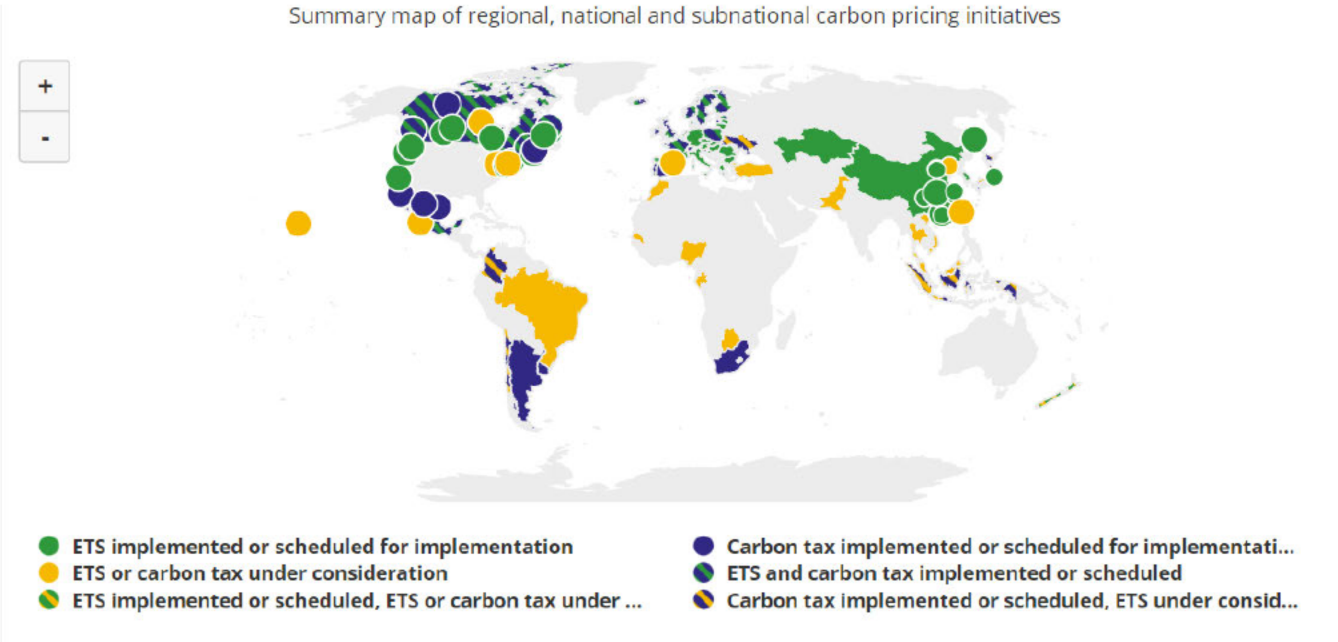
and close geographic proximity to suitable storage sites in the territorial waters of neighbouring countries, have strengthened the case for the export and import of CO_2.

The role of carbon pricing mechanisms

A key driver of the development of transboundary CCS projects in Europe and elsewhere is the range of incentives placing a value on CO_2 streams, such as emissions trading, CO_2 taxes and tax credits linked to delivered emissions reductions. While the EU ETS is the best-known carbon market, there are 70 carbon pricing schemes around the world (Figure 5).

Figure 5 Summary map of regional, national and subnational carbon pricing initiatives as of April 2022 (World Bank Carbon Pricing Dashboard 2023)



These initiatives cover 11.86 $GtCO_2e$ or 23% of global GHG emissions and in 2021 generated USD 84.4 billion (AUD 126 billion) in revenue.

The carbon price level in many of the schemes is a sufficient incentive for cost-effective investment in CCS depending on industry, location and storage availability (Figure 6).

Figure 6 Prices in implemented carbon pricing schemes around the world as of 1 April 2022 (World Bank Carbon Pricing Dashboard 2023)

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As countries continue to revise their climate change commitments, carbon prices are only expected to rise.

Outlook for Australia

Australia's renewed domestic commitments to the technology's deployment and excellent storage resources, together with strong historical support for the technology's inclusion within the London Protocol, suggests it is well-placed to engage regionally and offer support to those new entrants seeking to deploy CCS. One example is the recently announced 'Bayu-Undan' project that will see CO_2 shipped from Australia to the offshore waters of Timor Leste for permanent storage [1].

Australia is also increasingly identified by countries throughout the region, as a potential destination for exported CO_2, a factor that may also further strengthen its position as a leader in the region.

Japan, South Korea and the Philippines are all Parties to the Protocol and successive studies have found that those nations likely have limited storage potential. These nations have limited accessible storage resources within their territorial boundaries, when compared to their total emissions. However, these nations also have limited knowledge of their offshore geology due to a lack of oil and gas development. Recent engagement with industry in Japan and South Korea, also suggests that the export of CO_2 for storage beyond their territories, may be a solution for addressing these nations' significant emissions in the near term[19].

In the context of rising carbon prices internationally, the establishment of several Asian carbon pricing schemes and other policy mechanisms targeting CCS directly and the presence of excellent storage resources, Australia has an opportunity to earn revenue by providing CO_2 storage. The revenue generated from this service may help offset the initial cost of infrastructure, in addition to also allowing Australian companies to store their own CO_2, thus lowering the cost of climate change mitigation here in Australia.

The interaction of the proposed amendments with greenhouse gas inventories and regulatory and reporting streams.

The 2009 amendment to the London Protocol enabling the transboundary CO_2 export and import activities, has implications for preparing greenhouse gas inventories and for regulatory and reporting streams. As highlighted previously, transboundary CO_2 export and import as part of the CCS value chain produces clear environmental benefits, with the capability of delivering deep CO_2 emissions reductions. However, the integrity and credibility of national greenhouse gas inventories and regulatory and reporting schemes is dependent on the extent to which these benefits are real and quantifiable.

National accounting schemes and regulatory programmes will need to consider a variety of stakeholders from multiple countries involved in a transboundary CCS project and clearly allocate responsibilities for reporting of CO_2 captured at source and stored in the reservoir, while also accounting for any CO_2 leakage in the transport chain and storage reservoir. An example of how reporting responsibilities can be allocated can be found in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, which includes guidance on accounting for greenhouse gas emissions and removals that result from the CCS value chain.

The guidelines provide that where CO_2 captured in one country (Country A) is to be transported for storage in another country (Country B), Country A is required to report the amount of CO_2 captured, any emissions from transport or temporary storage that takes place within the territory of Country A, and the amount of CO_2 exported to Country B. Country B in turn is required to report the volume of CO_2 imported, any emissions from transport and temporary storage (within the territory of Country B) and any emissions from injection and geological storage sites [20].

Under this allocation of responsibilities, where CO_2 is received for storage from another country, a country will be required to report the volume of CO_2 received (imported) and any emissions associated arising from the transport, temporary storage, injection and storage of the imported CO_2.

Australia's domestic mechanisms for reporting greenhouse gas emissions and regulatory and reporting schemes, provide for the reporting and crediting of CO_2 captured and stored within Australia. Currently, however, these mechanisms do not clarify reporting obligations relating to the transboundary CO_2 export and import activities, which the Institute identifies as a critical gap that is yet to be addressed.

The development of CCS-specific law and regulation remains a crucial driver for the deployment of the technology. Surrounded by high emitters within in the APAC region, many of whom do not possess sufficient domestic geologic storage capacity, Australia is in a unique position to facilitate transboundary CCS chains between these countries and realise the crucial global environmental benefits that such operations can provide. To realise the opportunities afforded, it is crucial that domestic greenhouse gas inventories and regulatory reporting schemes clarify reporting obligations to ensure that emissions reductions from transboundary CO_2 export and import operations are accurately quantified and verifiable.

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