

REPORT: SOUTHEAST ASIA CCS ACCELERATOR WORKSHOP (SEACA)

PART III: CREATING A TRANSNATIONAL ASIAN CCS VALUE CHAIN

27 & 28 AUGUST 2024

RENAISSANCE KL HOTEL & CONVENTION CENTRE, KUALA LUMPUR, MALAYSIA



SUPPORTED BY



Introduction

- The Southeast Asia CCS Accelerator (SEACA) is an initiative which aims to accelerate the commercial deployment of CCS in the ASEAN region to meet net-zero targets. This third workshop in the SEACA Workshop series had the theme of “Creating a Transnational Asian CCS Value Chain”, which focused on transnational transport issues for CO₂ geological storage.
- SEACA facilitates discussion, effective communication, and collaboration between the private and public sectors on various topics aimed at advancing the region’s economic and climate ambitions through CCS. The discussions cover the application of international law, the negotiation of bilateral or multilateral agreements and their relation to commercial contracts, the ownership and liability of CO₂, carbon accounting and accreditation for CCS projects, as well as the technical, operational, and infrastructure requirements for CCS projects.
- The 3rd SEACA workshop was held on 27 and 28 August 2024 in Kuala Lumpur, Malaysia, was co-organised by the Global CCS Institute (GCCSI) and the ASEAN Centre for Energy (ACE) and was kindly sponsored by the Asia Natural Gas & Energy Association (ANGEA). The workshop was hosted by the Ministry of Economy of Malaysia. The detailed agenda is attached as **ANNEX 1**.
- The workshop was attended by representatives of nine ASEAN Member States (Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam) plus Timor-Leste. Additionally, invited participant from other countries and from various sectors, including government entities, state-owned companies, industries, research institutions, consulting firms, law firms, and development banks. Over 150 delegates from 17 countries registered at the event, showing growth from the two previous workshops. The list of participants is attached as **ANNEX 2**.
- Presentations made at the Workshop are attached as **ANNEX 3**, subject to the presenter not requesting they not be published.

SESSION 1: Opening

1.1. Opening Remarks

1. Alex Zapantis, General Manager of External Affairs at the Global CCS Institute (GCCSI), welcomed attendees and emphasised the importance of effective communication and collaboration between the private and public sectors in driving CCS and other transition technologies. The agenda included sessions on various stakeholder perspectives, international law, carbon accreditation and accounting, platform operational requirements, and international support available for CCS development in Southeast Asia.
2. Ybhg. Dato' Luqman bin Ahmad, Deputy Secretary General (Macro) of Malaysia's Ministry of Economy, welcomed attendees to the CCS workshop and highlighted Malaysia's commitment to low-carbon development. He discussed the country's National Energy Transition Roadmap (NETR), which aims to accelerate energy transition and improve climate resilience through various initiatives, including Carbon Capture Utilisation and Storage (CCUS). Dato' Luqman announced that Malaysia plans to table a standalone CCS bill by November 2024, focusing initially on offshore CO₂ storage activities. The government aims to position Malaysia as a regional CCS hub, providing integrated solutions for industries in the Asia Pacific region. He emphasised the need for collective action and cooperation in addressing global warming and climate change, expressing Malaysia's readiness to work with strategic partners to achieve a sustainable, low-carbon economy for future generations.
3. Beni Suryadi, Deputy Executive Director of the ASEAN Centre for Energy (ACE), addressed the significant challenge of greenhouse gas emissions in ASEAN, highlighting the projected tripling of energy demand by 2050 and the dominance of fossil fuels. He emphasised the importance of Carbon Capture and Storage (CCS) technology in achieving climate goals, as recognised in the ASEAN Plan of Action for Energy Cooperation (APAEC). He announced the upcoming launch of the ASEAN CCS Deployment Framework and Roadmap at the 42nd ASEAN Ministers on Energy Meeting (AMEM) in September 2024. He also highlighted ongoing CCS initiatives, including the SEACA workshops and partnerships with organisations like JOGMEC and MRI.
4. Dr Han Phoumin, Senior Energy Economist from the Economic Research Institute for ASEAN and East Asia (ERIA), provided an overview of CCUS developments in Southeast Asia. He highlighted ERIA's Asia CCUS Network, which facilitates capacity building and knowledge sharing in the region. Phoumin noted that global CCUS facilities have reached a capture capacity of 421 million tonnes, with significant potential for deployment in Southeast Asia due to the region's numerous basins. He discussed regulatory progress in various ASEAN countries, particularly Indonesia's presidential regulation to facilitate transboundary CCUS projects. Dr Phoumin also mentioned ongoing pilot projects in Indonesia, Thailand, and Malaysia, with potential collaboration between Japan and Malaysia. He emphasised the region's substantial storage potential, estimating around 200 gigatonnes across six countries, with Indonesia alone having 70 gigatonnes. He concluded by stressing the importance of further regulatory development, monitoring, and verification to enable CCUS business growth in Southeast Asia, identifying it as crucial for the region's net-zero emission goals.

5. Paul Everingham, CEO of the Asian Natural Gas and Energy Association (ANGEA), outlined his organisation's role in promoting natural gas as a reliable low-carbon energy source in the Asia Pacific region. He emphasised ANGEA's focus on policy enabling low-carbon energy solutions to achieve both energy security and environmental objectives. Everingham highlighted the importance of developing cross-border CCS trade quickly and at scale to benefit Asian economies and the environment. He noted that CCS is projected to account for 60% of mitigation efforts in Asia by 2050, potentially capturing up to 3 gigatonnes of CO₂ annually. Everingham discussed the challenges of implementing cross-border CCS in Asia, including regulatory variations and geographic mismatches between capture and storage sites. He emphasised the need for government agreements to provide clarity and flexibility for commercial CCS projects. Lastly, Everingham highlighted the economic potential of CCS in the Asia Pacific, citing research suggesting it could support up to 300,000 job opportunities and add \$220 billion to the region's GDP by 2035.

1.2. Overview of CCS in Southeast Asia – Opportunity and Challenges

Alex Zapantis, General Manager, External Affairs, Global CCS Institute (GCCSI), shared the “Overview of CCS in Southeast Asia”, which has the following results:

- a. The CCS project pipeline has grown significantly from 2010 to March 2024, driven by strong policy initiatives. Key drivers include recognition of CCS in Nationally Determined Contributions and National Roadmaps, strengthened climate policies, national CCS targets, international initiatives like the Carbon Management Challenge, fiscal incentives, and CCS regulations.
- b. Developing a transnational CCS value chain in Southeast Asia offers opportunities such as reducing net-zero costs by trillions of USD, creating international CO₂ transport and storage trade, providing CO₂ management infrastructure, establishing low-emission industry hubs, protecting and creating jobs, and ensuring a just transition for communities.
- c. Southeast Asian countries are supporting CCS development: Australia with sectoral decarbonisation strategies and transboundary CO₂ transport regulations; Indonesia with regulatory frameworks and tax incentives; Japan with CO₂ storage regulations and CCS feasibility studies; Malaysia with CCS in energy transition plans; Singapore with capture hub studies; South Korea with the Carbon Dioxide Capture, Usage and Storage Act; Thailand with regulations and Petroleum Act amendments; and Timor-Leste with specific CCS project regulations.
- d. As of March 2024, the region had 50 facilities in development (67MtpaCO₂), four (4) under construction (7MtpaCO₂), and one (1) operating (4MtpaCO₂). Achieving net-zero targets will require gigatonne-scale CCS by mid-century, highlighting the need for significant scaling up.
- e. Establishing a transnational CCS value chain requires commercially available technology, human capital, sufficient geological storage, clear regulations, defined CO₂ ownership and liability, carbon accounting integrity, government agreements, capital, finance, insurance, community support, and a sound business case. These factors highlight the complexity and need for coordinated efforts.

SESSION 2: OPPORTUNITY FOR AN ASIAN CCS VALUE CHAIN

2.1. Perspective from Australian Government

Naomi Montalto, Assistant Director, Transboundary CCS Section, from Australia's Department of Climate Change, Energy, Environment, and Water (DCCEEW), presented "Australia's Role in Regional Decarbonisation". The Workshop noted the following highlights:

- a. CCS is integral to Australia's broader strategy for meeting climate ambitions. The government supports technologies that generate jobs, modernise industries, and create new opportunities, especially in regional areas. Australia emphasises the development of engineered negative emissions and carbon dioxide removal technologies to reduce greenhouse gases permanently.
- b. The Australian government ensures that CCS projects are effectively regulated, safe, and environmentally responsible. In May 2024, the government allocated AUD 32.6 million over four years for regional cooperation on carbon sequestration, establishing regulatory frameworks and bilateral agreements for cross-border CCS to reduce risks and provide investment certainty.
- c. Australia has developed a National Action List (NAL) to determine the suitability of CO₂ streams for offshore sequestration, releasing an interim NAL and permit application form for domestic offshore CCS projects. Key legislative frameworks for offshore CCS include the Offshore Petroleum and Greenhouse Gas Storage Act, Environment Protection (Sea Dumping) Act, and Environment Protection and Biodiversity Conservation Act.
- d. Australia is aligning its legislative changes with the 2009 amendments to the London Protocol to allow cross-border CO₂ export for offshore sequestration. The country is working on ratifying these amendments and establishing regulatory frameworks for cross-border CCS, using international models like the Northern Lights Project as guidance. Key considerations include marine environmental protection, monitoring and verification processes, and managing liabilities between exporting and receiving countries.

2.2. Perspective from the Indonesian Government

Bobby Permanahadi, Senior Oil and Gas Policy Analyst, from the Ministry of Energy and Mineral Resources of Indonesia, presented "The Opportunities on CCS Implementation in Indonesia: Collaborating CCS Ecosystem in Southeast Asia". The Workshop noted the following highlights:

- a. Indonesia has significant geological storage capacity and is actively preparing regulations to support CCS development. The government has introduced Presidential Regulation No. 14/2024 and MEMR Regulation No. 02/2023 to govern cross-border CCS projects and support carbon-neutral activities. According to the Global CCS Institute, Indonesia ranks 22nd globally in CCS readiness.
- b. Indonesia has established a scheme for developing CCS within existing oil and gas operations or as standalone projects through carbon storage licenses. The Ministry of Energy and Mineral Resources has streamlined processes to simplify and accelerate CCS projects. Cross-border CCS is essential for addressing limited storage capacity in Southeast Asia, with Indonesia allowing 30% of the total capacity for foreign carbon and requiring agreements between countries to facilitate carbon transportation.

- c. Indonesia has identified 15 potential CCS and CCUS projects with an appraisal target set for 2030. Notable projects include:
 - **Asri Basin CCS Project:** A collaborative effort between Indonesia's state oil company Pertamina and ExxonMobil, aiming to inject cross-border carbon from Singapore by 2030.
 - **EOR Projects:** Enhanced Oil Recovery (EOR) projects are already underway in fields like Sukowati and Gundih, where CCS is being utilised to improve oil recovery while storing CO₂.
 - **Tanggung EGR/CCUS Project:** This project is designed to extend gas rates to support LNG operations, with a focus on onshore compression and CO₂ injection. It includes the development of offshore infrastructure for CO₂ transportation and storage.
- d. Indonesia is focusing on the economic value of CCS through carbon trading in voluntary markets. Foreign carbon trading will be facilitated by aligning legal and regulatory frameworks to support these activities.

2.3. Perspective from Thailand Government

Dr. Apiradee Suwannathong, Senior Geologist, Department of Mineral Fuels, from the Ministry of Energy of Thailand, presented "The Current Status of CCS Development in Thailand". The Workshop noted the following highlights:

- a. Thailand has established a key platform to promote CCS projects with two working groups focused on policy and investment. This platform includes both government and private sector stakeholders and aims to drive the development of CCS technologies and regulations.
- b. The government is assessing geological formations to identify suitable areas for carbon storage, including onshore, nearshore, and offshore locations.
- c. Thailand's flagship CCS pilot project is the Arthit Pilot Project, which is expected to be operational by 2028. This project will serve as a model for future CCS projects in Thailand, demonstrating the feasibility of large-scale CO₂ capture and storage.
- d. The government is developing a regulatory framework to support CCS initiatives, working with both national entities and international partners to establish policies, incentives, and agreements. Department of Mineral Fuels leads the regulatory efforts, particularly focusing on geological assessments and storage site approvals, whereas the Ministry of Natural Resources and Environment is collaborating on the environmental regulations related to CCS. The framework is expected to be formalised in the coming years, with key regulations currently under review by various governmental bodies.

2.4. Perspective from the Singaporean Government

Cui Xiao Wen, Deputy Director (Carbon Mitigation), from the Ministry of Trade and Industry Singapore, presented "Singapore's Plans for CCS and The Next Steps". The Workshop noted the following highlights:

- a. Singapore aims to achieve net-zero greenhouse gas emissions by 2050, with a significant reduction target of 60 million tonnes of CO₂ equivalent by 2030. The country plans to peak its emissions by 2030 and then gradually reduce them, focusing on decarbonising its power and industry sectors, which together account for a substantial portion of emissions.

- b. CCS is identified as a crucial technology for decarbonising Singapore’s hard-to-abate sectors, particularly in the industrial and power generation sectors. By 2030, Singapore aims to achieve 2 million tonnes of CO₂ abatement through CCS initiatives, aligning with international climate agreements like the Paris Agreement.
- c. As of 2021, the industry sector contributes approximately 44% of Singapore’s total emissions, while the power sector accounts for about 40%. These sectors are key focus areas for CCS implementation to meet the country’s decarbonisation goals.
- d. Due to insufficient onshore storage sites, Singapore emphasises cross-border CCS projects. Three main strategies include:
 - Government-to-Government (G2G) Agreements: Singapore aims to develop G2G agreements to enable cross-border CCS projects, focusing on policy alignment and carbon accounting mechanisms.
 - CCS Deployment in Host Countries: Singapore seeks to partner with other countries to enhance the bankability and success of CCS projects in the region.
 - Operational Interoperability: Establishing common standards for CCS operations, such as shipping specifications and technological cooperation, is crucial for cross-border collaboration.

2.5. Perspective from the Korean Government

Eunsoo Jung, General Manager of Policy & Planning Division, from the Korea CCUS Association, presented “CCUS Policy and Roadmap of Korea”. The Workshop noted the following highlights:

- a. Korea announced its 2050 carbon neutrality pledge in 2020, with key climate legislations like the Framework Act on Carbon Neutrality (2021). By 2030, Korea aims to reduce CO₂ emissions by 11.2 million tonnes annually, and by 2050, the goal is to reduce emissions by 84.6 million tonnes per annum, primarily focusing on the power generation sector. CCS is expected to help avoid over 55 million tonnes of CO₂ emissions by 2050.
- b. The CCUS Act, effective from 7 February 2024, consolidates the regulatory landscape for the CCUS industry, defining its scope from carbon capture and storage to transportation. The Act promotes industry, offers incentives, and addresses legal gaps and conflicts in CCUS projects.
- c. Korea has launched an integrated energy project to demonstrate CCUS feasibility, aiming to capture 1.2 million tonnes of CO₂ per year from industrial facilities on Korea’s east coast. Due to limited domestic storage capacity, Korea is pursuing partnerships for overseas storage with countries like the U.S., Australia, Indonesia, and Malaysia. For example, a project with Malaysia involves transporting CO₂ from Korea to storage sites in Malaysia.
- d. The Ministry of Science and ICT introduced a “CCUS-led” project in May 2021 to develop a comprehensive model for integrating CO₂ capture with its utilisation in CCUS products, targeting demonstration by 2026.

2.6. Perspective from Japan Government

Makoto Kunieda, Deputy Director, Advanced CCS Project Division, CCS Project Department, from the Japan Organisation for Metals and Energy Security (JOGMEC),

presented “Results of the Second Round of Japan's Financial Support for Commercialisation of CCS Projects”. The Workshop noted the following highlights:

- a. Japan aims to store 6 to 12 million tonnes of CO₂ annually in the first phase (2023-2030), with potential for future expansion. The Advanced CCS Project will soon begin, showcasing significant CO₂ injection rates and Japan’s commitment to large-scale environmental leadership.
- b. Japan has full governmental support for CCS, including funding for feasibility studies and projects. However, challenges include limited resource production, increased risk management needs, and the essential requirement of data acquisition.
- c. Recent advancements in CCS-related legislation, specifically the CCS Act, have established a comprehensive regulatory framework to support CCS technology deployment. This includes necessary approvals and operational guidelines mandated by the government to ensure projects meet strict environmental and safety standards.
- d. One of Japan’s flagship CCS projects in Hokkaido captures CO₂ from a hydrogen production facility and stores it in deep saline aquifers offshore. The project has successfully injected over 300,000 tonnes of CO₂, demonstrating the technical feasibility of offshore CO₂ storage. Looking ahead, Japan is focused on scaling up CCS deployment, integrating it with other green technologies, and achieving carbon neutrality goals by 2050 through continued government support, international cooperation, and innovative approaches.

2.7. Perspective from Malaysian Government

Dr Noranida Zainal, Director of environmental and Natural Resources, from the Ministry of Economy, presented “CCUS Policies and Roadmap for Malaysia and Beyond.” The Workshop noted the following highlights:

- a. Dr Noranida Zainal emphasised the importance of sustainability in Malaysia’s development agenda, focusing on natural resource management and climate change mitigation. The Ministry aims to balance economic growth with environmental preservation, targeting net-zero carbon dioxide emissions by 2050.
- b. CCS projects are significant for supporting circular economies, producing products like e-methanol, cosmetics, carbon fibre, concrete, and micro-algae. Although Malaysia lacks a dedicated CCS policy, these initiatives are part of the National Energy Transition Roadmap (NETR) and the New Industrial Master Plan (NIMP). CCS is one of six key levers for the energy transition, alongside Energy Efficiency, Renewable Energy, Hydrogen, Bioenergy, and Green Mobility.
- c. On 1 May 2024, the Malaysian government agreed to establish a comprehensive legal framework for CCS implementation. This framework includes a new bill covering carbon capture, transportation, utilisation, and storage, expected to be introduced by the end of 2024. A federal governance body will oversee the regulation and coordination of CCS projects across the country.
- d. Malaysia is in discussions with countries like Singapore, Japan, and South Korea to establish frameworks for cross-border CO₂ transportation and storage. Initial MoUs are being developed to outline cooperation, responsibilities, and shared benefits, ensuring compliance with international protocols like the London

Protocol. Malaysia aims to commence its first CO₂ injection by 2027-2028, focusing initially on capturing CO₂ from major industrial sources and utilising existing oil and gas fields for storage, with plans for expansion into other sectors and storage sites.

2.8. Perspective from Timor-Leste Government

Luzerio Teme, CCS Coordinator, CCS Division, from the Ministry of Petroleum and Mineral Resources, presented “Future Outlook for CCS in Timor-Leste: Vision and Challenges”. The Workshop noted the following highlights:

- a. Timor-Leste’s proximity to significant CO₂ emitters in the Asia-Pacific region, coupled with its geological formations, makes it a potential hub for regional CCS initiatives. The Bayu-Undan Field, a large gas condensate field located offshore, is nearing the end of its productive life, presenting an opportunity to repurpose the infrastructure for CO₂ storage. The project has significant economic and environmental benefits, including job creation, economic diversification, and the storage of CO₂ emissions, thus contributing to global climate targets.
- b. The geological conditions of the Bayu-Undan Field are favourable for CO₂ storage, with an estimated capacity of over 200 million tonnes. The field could support an injection rate of approximately 10 million tonnes of CO₂ per annum, facilitated by five injection wells.
- c. Timor-Leste, in collaboration with Santos and other partners, has signed MOUs to advance this project. However, challenges remain, especially in the form of regulatory delays. A draft CCS decree law, essential for establishing the legal framework for CCS operations, is currently awaiting parliamentary approval.
- d. Timor-Leste’s partnership with Australia positions both countries to become key players in Asia’s CCS value chain. The region’s strategic location and geological characteristics, particularly in the Bonaparte Basin, make it an ideal candidate for large-scale CO₂ storage. Despite legislative challenges, the potential for Timor-Leste to serve as a regional CCS hub remains promising, and the country looks forward to collaborating with international partners to achieve its goals.

2.9. Panel Discussion

Dr Han Phoumin, Senior Energy Economist from ERIA, moderated the Panel Discussion. The Workshop noted the following highlights from the discussion:

- a. **Cross-Border CCS Challenges and Policy Alignment:** The panel discussed the challenges and opportunities related to cross-border CCS, emphasising the need for regulatory alignment and environmental protection. Singapore and Australia highlighted the importance of bilateral agreements, with Singapore focusing on developing Government-to-Government (G2G) agreements and Australia discussing legislative frameworks necessary for offshore CCS projects.
- b. **Investment and International Collaboration:** The discussion underscored the need for investment in CCS projects and the role of international collaboration in achieving CCS goals. South Korea and Japan highlighted their financial support mechanisms and partnerships. South Korea’s CCUS Act offers incentives for industries, while Japan’s government actively supports feasibility studies and project funding for selected advanced CCS projects led by private companies.
- c. **Environmental and Social Considerations:** The panel addressed the importance of environmental and social considerations in CCS projects to ensure

public confidence and compliance with international standards. Malaysia and Timor-Leste discussed their efforts in developing legal frameworks and engaging with stakeholders to support CCS initiatives. Both countries are prioritising stakeholder engagement to build public confidence and ensure transparency in their CCS projects. The importance of adhering to rigorous environmental protection measures and considering the social impact on local communities was stressed as fundamental to ensuring the long-term sustainability of CCS initiatives.

- d. **Future Outlook and Ongoing Collaboration:** The panel concluded with a positive outlook on the future of CCS in the region, emphasising its critical role in meeting decarbonisation goals. Several countries acknowledged the significant potential for CCS to accelerate carbon reduction efforts in industries such as oil, gas, and heavy manufacturing. The future of CCS was portrayed as one that depends heavily on ongoing collaboration between countries, industries, and research institutions. The panel highlighted the need for continuous knowledge sharing, particularly regarding technological advancements, project execution, and lessons learned from early CCS projects. Looking ahead, the panel recognised that overcoming existing challenges—such as high costs and regulatory barriers—would require a concerted and cooperative effort across borders to realise the full potential of CCS in Asia.

SESSION 3: INTERNATIONAL LAW

3.1. Presentation from A&O Shearman

Scott Neilson, Partner, from A & O Shearman, presented “Going Beyond the London Protocol: New G2G and B2B Agreements Underpinning CCS Projects”. The workshop noted the following highlights:

- a. The London Protocol, which protects the world’s seas from hazardous waste dumping, underwent significant amendments related to CCS. In 2006, an amendment allowed CO₂ geological storage in sub-seabed formations, followed by a 2009 amendment permitting the export of CO₂ for disposal, requiring bilateral agreements and specific environmental protection guidelines. However, only six countries had ratified the 2009 amendment after 10 years, creating implementation challenges for cross-border CCS projects.
- b. The Asia-Pacific region is experiencing growing momentum for CCS but faces unique challenges. The ineffectiveness of the London Protocol and the fact that most Southeast Asian countries are not party to the London Convention necessitate bilateral agreements for transborder CO₂ transport. A suggested approach includes developing high-level government-to-government agreements with light-touch contents and amending CCS laws to address site selection, environmental protection, and permitting processes.
- c. Liability and ownership issues for stored CO₂ vary among countries, with some jurisdictions transferring long-term liability to the state and others maintaining operator responsibility. Various models for CO₂ transport and storage exist, including fully integrated companies and separate entities. Revenue sources may include government subsidies, carbon pricing mechanisms, and fees from emitters. Understanding these models is crucial for developing effective CCS projects and attracting investments.

- d. For CCS hub projects in the Asia-Pacific region, a proposed model involves multiple emitters, a transport and storage company, and significant government support. Considerable subsidies, equity from sponsors, and involvement of multilateral development banks and export credit agencies are expected. Key provisions for transport and storage agreements include service responsibilities, pricing structures, CO₂ specifications, liability clauses, and dispute resolution mechanisms, essential for establishing clear operational frameworks and ensuring long-term viability of CCS projects.

3.2. Presentation from Ashurst

Guy Dwyer, Partner, from Ashurst, presented “Translating International Law Considerations for Transboundary CCS Projects into Domestic Law: Risks and Opportunities”. The Workshop noted the following highlights:

- a. The international legal framework for CCS projects is complex, involving multiple conventions such as the London Protocol, United Nations Convention on the Law of the Sea (UNCLOS), Basel Convention, International Convention for the Prevention of Pollution from Ships (MARPOL), International Convention for the Safety of Life at Sea (SOLAS), and the Paris Agreement. These agreements impact various aspects of CCS projects, from marine environmental protection to safety regulations for CO₂ transport by ship.
- b. The Paris Agreement is crucial in driving CCS development, requiring parties to explore all viable options to reduce CO₂ emissions, including CCS technology. Countries with advantageous conditions for CCS are expected to legislate domestically to support these projects, contributing to more ambitious Nationally Determined Contributions (NDCs) and meeting their obligations under the agreement.
- c. Implementing CCS projects domestically faces several risks, including the absence of CCS-specific legal and regulatory regimes, challenges related to third-party rights and public participation, difficulties in obtaining a “social license” to operate, potential liability issues for CO₂ leakage, lack of financial incentives, and technical expertise shortages. However, there are significant opportunities, such as developing regulatory frameworks for carbon markets, meeting Paris Agreement obligations, facilitating cooperative approaches, balancing third-party rights with streamlined assessment processes, building stakeholder awareness, and developing innovative liability and insurance schemes.
- d. Despite the challenges, there are significant opportunities associated with domestic implementation of CCS projects. These include involvement in developing regulatory frameworks for carbon markets, meeting Paris Agreement obligations, facilitating cooperative approaches to assist other countries, striking a balance between third-party rights and streamlined assessment processes, building stakeholder awareness, and developing innovative liability and insurance schemes.
- e. The presentation concludes that large-scale CCS is inevitable to limit global warming to well below 2°C. Countries with CCS potential must create a supportive regulatory environment to facilitate technology and project development. Urgent attention is needed to establish facilitative regulatory frameworks in countries with competitive advantages in CCS, balancing risks

and opportunities to ensure effective implementation of this crucial technology in combating climate change.

3.3. Presentation from IEA GHG

Tim Dixon, General Manager, from the IEA Greenhouse Gas R&D Programme, presented “London Protocol (and IPPC) on Transboundary CCS Projects”. The Workshop noted the following highlights:

- a. The London Protocol, designed to prevent hazardous waste dumping into the world’s oceans, faced implementation challenges for cross-border CCS projects, as only six countries had ratified the 2009 amendment even after ten years. This 2009 amendment permitted the export of CO₂ for storage but required bilateral agreements and adherence to strict environmental protection measures. Earlier, in 2006, a significant amendment had allowed CO₂ to be stored in sub-seabed geological formations, marking an important step in advancing CCS efforts.
- b. To address ratification challenges, a provision for early application of the 2009 export amendment was adopted in 2019, driven by Norway’s Northern Lights Project. This allowed countries to proceed with cross-border CCS projects before full ratification, providing a practical solution to implementation hurdles.
- c. In 2022, CO₂ export guidelines were revised to clarify definitions and requirements. Several European countries have since signed bilateral agreements for cross-border CO₂ transport and storage, demonstrating growing interest and commitment to CCS projects. The European Commission’s analysis stated that the CCS Directive acts as an arrangement between EU member states, streamlining the process within the European Union.
- d. The IPCC added a chapter on CCS transport and injection in geological storage, providing crucial information on emissions accounting for transboundary CCS projects. This guidance includes four scenarios for different cross-border situations:
 - Captured in one country and stored in another
 - Captured in one country, transported through another, stored in third country
 - Captured and stored within the same country but involves transport through international waters
 - Captured in one country, used in another country before being stored

The guidance assumes zero emissions for properly managed sites unless monitoring indicates otherwise. The evolving international legal framework emphasizes bilateral agreements and clear accounting methods for greenhouse gas emissions, ensuring environmental protection and accurate emissions accounting in CCS projects.

3.4. Panel Discussion

Ian Havercroft, General Manager, Knowledge & Analysis, from the Global CCS Institute, moderated the Panel Discussion. The Workshop noted the following highlights from the discussion:

- a. **Financing and Incentives for CCS projects:** The discussion highlighted differences in financing CCS projects between Northern Europe and other regions. In Northern Europe, projects often involve large state-backed organisations and countries with high credit ratings. In regions with lower credit ratings, financing institutions may need to provide funding at various stages.

Subsidies and incentives, such as Malaysia's income tax credits and Japan's JOGMEC subsidies, are crucial for motivating emitters to cover transportation and storage costs.

- b. **Funding Sources and Risk Management:** A mix of funding sources for CCS projects was discussed, including equity, debt, and potential grant funding. Organisations like the Japan Bank for International Corporation and multilateral development banks were mentioned as potential funders. Managing liability risks is essential, as problematic local liability laws could block or limit projects. Proper geological assessment and reservoir management can mitigate leakage risks.
- c. **Regulatory Issues and Bilateral Agreements:** Critical regulatory issues include the transfer of liability and emissions leakage responsibility. Balancing third-party rights with streamlined project assessment processes is necessary. Local laws and high-level government-to-government agreements are important for facilitating CCS projects. These agreements should be "light touch" to avoid impeding projects.
- d. **Emissions Accounting and Future Outlook:** The complexity of emissions accounting for CO₂ transport in international waters poses significant challenges for CCS projects. Scott Nelson highlighted the lack of clear guidelines, particularly regarding how emissions during maritime transport affect countries' NDCs under the Paris Agreement. The panel stressed the need for robust regulatory frameworks to balance existing regulations with project urgency. Despite challenges, the outlook for CCS remains positive, with ongoing efforts to address financing through mechanisms like JOGMEC subsidies and risk management through proper geological expertise and reservoir management.

SESSION 4: BILATERAL AND MULTILATERAL AGREEMENTS

4.1. Presentation from ExxonMobil

Casey Delhotal from ExxonMobil, representing ANGEA (Asia Natural Gas & Energy Association), presented "ANGEA Accelerating Cross Border CCS in Asia Pacific." The Workshop noted the following highlights:

- a. Casey Delhotal presented a systematic review of EU regulations, IPCC protocols, and domestic laws to identify regulatory gaps for cross-border CCS projects. Insights from Boston Consulting Group highlighted existing agreements and areas needing improvement. They provided recommendations on what should be considered in government-to-government (G2G) agreements versus commercial agreements. Five key recommendations were made for bilateral agreements on cross-border CCS projects:
 - Agree that the capturing country retains the right to emission reductions
 - Agree on jurisdictional accountability for emission reversals from leakages and acceptable mechanisms for the adjustment of such reversals
 - Agree to share data for emission reduction certification
 - Agree on regulatory jurisdiction during CO₂ transportation over international waters or 3rd party countries
 - Agree on dispute resolution mechanisms, including arbitration forums
- b. ANGEA is also contributing by drafting regulatory recommendations, and part of this work has involved government engagement. ANGEA had multiple

conversations with Australia, Singapore, Indonesia, Malaysia, Japan, and Korea to ensure that they incorporated each country's views and understood the origins of the recommendations. The draft recommendations aim to align with current agreements and future innovations, simplifying decision-making within commercial agreements while remaining technology-neutral to encourage ongoing advancements in CCS technologies.

- c. Key recommendations include clarifying ownership of emission reductions, establishing responsibility across the value chain, data-sharing protocols for sensitive information, defining regulatory jurisdiction, and setting up a dispute resolution mechanism for international agreements. ANGEA plans to continue its dialogue with governments, aiming to publish a report by the end of the year and establish the first official government-to-government agreement on cross-border CCS by the end of next year.

4.2. Presentation from Santos

Matthew Sherwell, Senior Manager Regulatory & Market Development, from Santos Ltd, presented “Agreement or Arrangement - Options to Meet the Provisional Application of Article 6 Amendment”. The Workshop noted the following highlights:

- a. The Moomba CCS project in Moomba Gas Plant, operated by Santos in South Australia, is rapidly advancing with construction complete, including injection wells, pipelines, and mechanical systems. The project aims to store 1.7 Mt CO₂ a year in phase one. Regulatory approvals, such as the CO₂ Disposal License and injection approval, are secured, and the project is now in its final commissioning stages.
- b. Pre-commissioning activities have been finalised, and system readiness reviews are underway. Plant start-up and the first CO₂ injection are expected by Q3 2024, marking a significant milestone for the project's operational phase.
- c. Efforts are being made to streamline regulatory frameworks in Timor-Leste, which are essential for advancing regional CCS projects. Santos also focuses on establishing bilateral agreements to avoid potential project delays, exploring MOUs as a fast-track solution for regulatory approvals and project execution.
- d. The project is on track for a successful launch, with efforts to ensure that both the operational and regulatory aspects are aligned. This supports the broader vision of CCS expansion across the region, setting precedents for future initiatives.

4.3. Presentation from Shell

Sue-Ern Tan, Head Policy and Advocacy Asia Pacific, from Shell, presented “Bilateral Agreements – Lynchpin for an APAC CCS Value Chain”. The Workshop noted the following highlights:

- a. The presentation emphasised the potential for CCS projects across Japan, Malaysia, Indonesia, and Australia, where promising storage opportunities exist. The focus is on regional cooperation to optimise project costs and stimulate strategic growth within the APAC region.
- b. Shell uses a structured decision-making framework that includes assessing cost-value relationships, potential capital allocation, and alignment with long-term strategic goals. Legal, economic, and technical risks are carefully evaluated to ensure projects align with regulatory and financial incentives.

- c. Legal and regulatory frameworks, such as the EU CCS Directive, are critical for mitigating risks and ensuring successful project implementation. These frameworks also manage long-term infrastructure, environmental protection, and decommissioning responsibilities.
- d. Financial incentives, including government subsidies and grants from entities like the Norwegian government and European Commission, are crucial for making large-scale investments viable. Shell highlights a \$7 billion investment supported by a \$10 million cost-value ratio to show the scale of required financial backing.
- e. Cross-border cooperation, particularly through binding bilateral agreements, is seen as essential for creating a viable CCS market. Examples of successful cross-border agreements, such as those between the Netherlands and other EU nations, serve as models for future CCS projects in the APAC region.

4.4. Presentation from Air Liquide

Floris Mackor, Large Industries VP Strategy CCS and Ammonia, from Air Liquide, presented “Challenges & Achievements of Cross-Border Agreements”. The Workshop noted the following highlights:

- a. Air Liquide recognises the critical role of CCS in achieving net-zero emissions. The company is fully committed to integrating CCS into its operations as a long-term strategy for sustainability, emphasising that net-zero goals are impractical without CCS technology.
- b. The implementation of CCS projects, particularly in Europe, faces significant challenges, such as the need for more proactive approaches in project execution and legal adjustments to support CCS initiatives. Addressing these challenges is key to the success of future projects.
- c. Air Liquide is focused on capturing CO₂ from smaller emitters and advancing mineralisation processes that transform CO₂ into useful materials. This approach not only helps reduce emissions but also contributes to creating valuable byproducts, making the process more economically viable.
- d. The pace of CCS development in Asia is slower than in the US and Europe. With fossil fuels expected to account for 80% of Asia's energy consumption in the near future, CCS will play a critical role in reducing the region's carbon footprint. Lessons learned from European CCS projects can offer valuable insights into Asia's development.
- e. A unified legal framework is vital for the successful implementation of CCS projects. Air Liquide experienced a decade of delays in a CCS project due to legal complexities, which only progressed once these issues were resolved. Governments must ensure early involvement and social acceptance to facilitate CCS initiatives.

4.5. Presentation from Mitsui O.S.K. Lines, Ltd. (MOL)

Sony Rajan, General Manager, CCUS Business Development Team, from MOL, presented “MOL's Initiatives for Cross-Border CO₂ Transportation and CCUS”. The Workshop noted the following highlights:

- a. MOL plays a crucial role in the transportation of CO₂, connecting capture sites to storage locations. Although capture and storage are often the focus, transportation is equally vital for the success of the CCUS value chain.
- b. Positioned centrally in the CCUS value chain, MOL ensures efficient CO₂ transport, which is necessary to make CCUS projects viable. The company

emphasises the need to highlight the importance of this transportation link, which is sometimes overshadowed by other aspects of the CCUS process.

- c. Economic viability remains a concern for CCUS, with transportation costs ranging from 90 to 180 Euros depending on various factors. Subsidies or other financial mechanisms are necessary to bridge the gap between current CO₂ prices and the actual costs of transportation and storage.
- d. The London Protocol serves as the primary global regulatory framework governing seaborne transportation and sub-seabed storage of CO₂. MOL stresses the importance of including transportation companies in these regulatory frameworks to ensure a seamless transition of CO₂ between capture and storage stages.
- e. MOL is investing heavily in the future of CO₂ transportation, including a strategic partnership with Lovett Shipping, which specialises in CO₂ tankers. This move reflects MOL's long-term commitment to expanding its role in CCUS and supporting the growing market for CO₂ transport across borders.

4.6. Presentation from PETRONAS

Lou Khee Fang, CCS Project Management Head, from PETRONAS, presented "Solution for Local and Regional Decarbonisation". The Workshop noted the following highlights:

- a. Petronas committed to net-zero carbon emissions by 2050, announcing their pathway in November 2022. The plan outlines initiatives to reduce greenhouse gas emissions across operations. Short-term targets include to cap emissions at 49.5 MtCO₂e of Scope 1 and Scope 2 GHG emission from PETRONAS' Malaysia operations by 2024.
- b. Since 2022, Petronas has intensified efforts to develop CCS solutions through partnerships and innovations. They focus on capturing CO₂ emissions and storing them in geological formations. Three CCS hubs are proposed: Northern Hub (Kerteh, Peninsular Malaysia), Central Hub (Kuantan, Peninsular Malaysia), and Southern Hub (Bintulu, Sarawak), each designed with an initial capacity of 5 million tonnes per annum.
- c. Petronas completed the conceptual design for Liquid CO₂ carriers in June 2023, achieving "Approval in Principle" (AiPs) from DNV and ABS, which indicates that the classification societies have reviewed and approved the basic design of the LCO₂ carriers as well as the Floating Storage and Offloading Unit (FSO), as they fulfil the technical requirements and safety criteria. In 2024, they plan to receive main design approval for long-haul ships, crucial for enabling cross-border CO₂ transportation and supporting regional CCS initiatives.
- d. Collaboration is key for successful CCS implementation. Petronas emphasise building strong relationships across sectors and countries. They highlight the need for Government-to-Government agreements for regulatory alignment and Business-to-Business arrangements for commercial terms and operational considerations. Regulatory and legal considerations are vital in CCS deployment.
- e. Petronas actively pursues a strategy for net-zero emissions through advanced CCS solutions and infrastructure. Success depends on collaboration, robust regulations, and innovation. The company remains committed to global decarbonisation efforts, demonstrating dedication to addressing climate change and promoting sustainability in the energy industry.

4.7. Panel Discussion

Alex Zapantis, General Manager, External Affairs, from Global CCS, moderated the Panel Discussion. The Workshop noted the following highlights from the discussion:

- a. **Regulatory Frameworks and Commercial Agreements:** The discussion highlighted the need for clear and supportive regulatory frameworks for CCS projects. The Northern Lights Project in Norway exemplifies how governmental support and regulatory certainty are essential for encouraging commercial partnerships and managing regulatory risks. Ensuring government regulations support commercial agreements can alleviate concerns about regulatory risks for companies.
- b. **Incentives and Cost Management:** Incentives for decarbonisation, such as Malaysia's income tax credits and Japan's JOGMEC subsidies, are crucial for motivating emitters to cover transportation and storage costs. The Netherlands uses a levy or tax on large emitters to drive companies towards CCS. Cost variations across the CCS value chain, from capture to storage, depend on industry, technology, and existing infrastructure, making clear cost structures and expectations essential.
- c. **Transportation, Storage, and Monitoring:** Various CO₂ transportation methods, including pipelines and ships, were discussed. Pipelines are cost-effective for shorter distances, while ships may be more viable for longer distances. Post-storage monitoring is significant, with Malaysia's (Sarawak) regulatory framework requiring 25 years of monitoring by the project developer before transferring responsibility to the state or country.
- d. **Collaboration, Bilateral Agreements, and Smaller Operators:** Collaboration among companies involved in capture, transportation, and storage is vital for CCS projects. Forming consortiums helps overcome technical and regulatory challenges. CCS projects are capital intensive, and securing financial incentives to make them happen is important. To achieve this, more collaboration and dialogue between the industry and government are necessary. The government needs to understand what companies are facing in terms of costs and technical challenges. Smaller operators can integrate into the CCS value chain by aligning with larger consortiums, despite the need for extensive collaboration.

Day 2 (28 August 2024)

SESSION 5: CARBON ACCREDITATION FOR CCS PROJECTS

5.1. Presentation from the International Emissions Trading Association (IETA)

Takashi Hongo, Senior Fellow, Mitsui & Co. Global Strategic Studies Institute, and Co-Chair of Japan WG from the IETA, presented "Accounting and Sustainability for Monetisation of CCS". The Workshop noted the following highlights:

- a. Carbon markets are crucial for monetising CCS, divided into compliance markets like Malaysia's national ETS and Japan's GX-ETS and growing voluntary markets. However, market fragmentation and supply-demand gaps challenge monetisation. Current carbon prices, such as \$30/tonne in Japan and €60-70/tonne in Europe, are insufficient to cover CCS costs. Significant price increases and additional government support are needed for economic viability by 2030-2050.

- b. Accurately quantifying carbon reduction through CCS requires further research. CCS must be recognised in Nationally Determined Contributions (NDCs) to gain political backing. Guidelines for cross-border CCS projects, expected by 2027, will standardise carbon accounting and financial processes. IETA developed high-level criteria for crediting carbon storage activities. The criteria are divided into two structures: methodological components (leakage, boundaries, applicability conditions, monitoring, additionality, and baseline) and safeguards (political acceptance, legal & regulatory requirements, and risk assessment).
- c. At the recent carbon conference in Singapore, several key challenges and observations were noted, including the fragmentation of carbon markets, a lack of demand despite a growing supply of carbon credits, and the early-stage development of markets like Carbon Capture and Storage (CCS) and removal markets. Additionally, in the aviation sector, which faces significant decarbonisation challenges, lower-carbon fuels such as sustainable aviation fuel (SAF) are being explored, with CCS having the potential to reduce emissions in fuel production by up to 10%.
- d. Effective communication with stakeholders is critical for overcoming negative perceptions of CCS and gaining support. International frameworks, like the International Aviation Sciences Emission Reduction Strategy, work to standardise carbon accounting, which is essential for building trust and ensuring long-term success for CCS initiatives.
- e. Collaboration among companies and forming consortiums are vital for CCS projects. Incentives for decarbonisation, such as Malaysia's income tax credits and Japan's JOGMEC subsidies, motivate emitters to cover transportation and storage costs. Addressing barriers to entry for smaller operators and ensuring clear cost structures and expectations are crucial for successful CCS implementation.

5.2. Presentation from Mitsubishi Research Institute, Inc (MRI)

Tetsuya Nomoto, Senior Researcher from the MRI presented "Positioning Carbon Capture Storage (CCS) in Carbon Pricing to Decarbonise in ASEAN". The workshop noted the following highlights:

- a. To effectively deploy CCS in the ASEAN region, it is essential to identify markets where CCS can be integrated into existing energy and industrial infrastructures. Establishing or strengthening legal frameworks covering regulations, carbon pricing mechanisms, and compliance with international standards is crucial to ensure the viability and attractiveness of CCS projects to investors.
- b. Creating sustainable business models for CCS is crucial due to the high costs associated with the technology. These models should explore financial feasibility through subsidies, incentives, public-private partnerships, and innovative financing mechanisms. Involving the private sector in CCS financing can be encouraged through incentives such as subsidies, tax breaks, or carbon credits. Emission Trading Schemes (ETS), like the EU ETS, could be tailored to local conditions in the ASEAN region to provide financial incentives for CCS adoption.
- c. CCS projects can generate carbon credits by capturing emissions, which can be traded or used to meet carbon reduction obligations. Ensuring accurate accounting of emissions reductions is crucial to avoid double counting and maintain the credibility of carbon markets.

- d. ASEAN countries could benefit from regional cooperation on CCS, particularly regarding cross-border CO₂ transportation and storage. Collaborative infrastructure projects can reduce costs and enhance feasibility. Additionally, CCS can be integrated into the production of carbon-neutral fuels such as hydrogen and ammonia, contributing to decarbonising hard-to-abate sectors.

5.3. Presentation from ExxonMobil

Casey Delhotal, Senior Director, International Government Relations, Asia Pacific, from the ExxonMobil Corporation, presented “Pathways to Credits for Cross Border CCS”. The Workshop noted the following highlights:

- a. Recognising CCS within Nationally Determined Contributions (NDCs) is crucial for attracting large-scale investments, particularly for cross-border CCS projects. This political backing offers legitimacy and security, facilitating investments that can reach billions of dollars. Additionally, the need for internationally recognised CCS methodologies in both voluntary and compliance markets is critical. Greater alignment with IPCC guidelines is necessary to clarify carbon accounting in cross-border CCS projects, helping define how credits are generated and applied in different jurisdictions.
- b. The high cost of CCS projects presents a significant economic barrier. Current carbon prices in Asian markets (USD\$10 to US\$20 per tonne) fall significantly short of the US\$100 to US\$115 per tonne needed for CCS viability. More countries are incorporating CCS into tax regimes or Emissions Trading Systems (ETS), particularly in heavy manufacturing sectors. Governments in regions like Europe have bridged this gap through subsidies, but similar support is needed in Asia.
- c. For the foreseeable future, CCS projects will require substantial government support, as carbon credits alone will not cover the high costs. Industries and governments must explore shared infrastructure to reduce costs. Private sector participation, driven by voluntary credits and net-zero commitments, will also help advance CCS. Effective communication with stakeholders is critical for overcoming negative perceptions and gaining support.
- d. As carbon prices increase and markets mature, government intervention may decrease. Until then, collaboration between governments, industries, and private sector stakeholders is essential. Shared infrastructure across industries and countries will reduce costs and make CCS more economically feasible in the long term. International frameworks and standardised carbon accounting are essential for building trust and ensuring the success of CCS initiatives.

5.4. Panel Discussion

Hanh Le, Advisor from the ANGEA moderated the Panel Discussion. The Workshop noted the following highlights from the discussion:

- a. **Transition from Clean Development Mechanism (CDM) to Article 6.4:** The shift from the CDM to Article 6.4 under the Paris Agreement involves complexities like corresponding adjustments for carbon credits between host and investor countries. The CDM was established under the Kyoto Protocol to allow developed countries to invest in emission-reducing projects in developing countries, earning credits that could be used to meet their own emission-

reduction targets. Article 6.4 builds on the experience of CDM but aims to improve operational efficiency and transparency in carbon markets.

- b. **Voluntary Carbon Markets:** The voluntary carbon market faces challenges due to minimal government intervention, with some countries like Indonesia considering controlling the issuance and export of voluntary carbon credits. Panellists emphasised consulting market players before implementing such controls, as their participation is crucial for financing innovative, negative emission technologies. For capital-intensive CCS projects, creating voluntary credits without a pre-arranged buyer is not feasible. The voluntary carbon market is essential for funding the development and implementation of new, negative emission technologies.
- c. **Government and Public Sector Financing for CCS:** CCS projects require significant capital, often necessitating concessional loans or other financial support from public sector institutions like the World Bank and Asian Development Bank. Japan's Green Transformation Fund, a type of transition bond financed by future carbon pricing, supports the development of decarbonisation technologies and may eventually finance actual CCS projects. Beyond carbon pricing, governments can provide additional support by integrating CCS into broader decarbonisation strategies, such as through the production of carbon-neutral fuels or tendering processes for decarbonised power. Regional collaboration, especially in ASEAN, is vital for building the necessary infrastructure and market mechanisms to support CCS, including shared infrastructure and harmonised carbon pricing policies across borders.
- d. **Cross-Border CCS, Carbon Accounting, and Future of Carbon Pricing:** A crucial question is how emissions should be accounted for in cross-border CCS projects. In Europe, a common framework under the ETS system helps manage this, but in other regions, it is unclear when the responsibility for emissions should be transferred—from the point of capture to storage or during transportation. The responsibility for any leakage, whether during transport or storage, must be clearly defined, with current IPCC guidelines lacking clarity on when and where emissions should be accounted for. For CCS to be viable, carbon pricing mechanisms need to be robust and include pass-through mechanisms, where the cost of carbon is ultimately borne by the end consumer. Promoting competition among CCS technology providers is essential to drive innovation and reduce costs, supported by clear, long-term carbon pricing policies.
- e. **Reducing CCS Costs, Supporting Innovation, and Stakeholder Communication:** Governments must continue to support technological innovation and infrastructure development to reduce CCS costs. This includes building shared infrastructure, such as hubs for CO₂ capture and storage, which can lower costs for multiple projects. Long-term, stable policies are crucial for encouraging private sector investment in CCS, providing assurance that these policies will remain in place for decades, matching the long-term nature of CCS projects. Effective communication with stakeholders, including the public and private sectors, is necessary to address concerns and build support for CCS as a critical component of decarbonisation strategies.

SESSION 6: TECHNICAL, OPERATIONAL, AND INFRASTRUCTURE REQUIREMENTS

6.1. Presentation from BP Asia Pacific

Zulfikri Agus, Performance Manager from BP Asia Pacific, presented “Tangguh CCUS: An Indonesian National Strategic Project”. The Workshop noted the following highlights:

- a. Tangguh, Indonesia’s largest gas producer located in Bintuni Bay, West Papua, produces 2.1 BCF/day of gas, with a capacity of 11.4 Mtpa after the addition of Train 3 in 2023. Operated by BP since 2009 in collaboration with partners like Mitsubishi, the project aims to decarbonise LNG production by capturing 30 million tonnes of CO₂ and reinjecting it into the original reservoir, enhancing gas recovery by around 400 BCF.
- b. Tangguh holds a CO₂ storage capacity of 1.8 gigatonnes, which may turn it into a CCS hub for regional industries. Currently, only 2% of this capacity is utilised, but future expansion could involve building additional facilities for wider CO₂ injection.
- c. Key infrastructure upgrades include adding units like acid gas removal and CO₂ compressors, with the aim of injecting 4 Mtpa of CO₂ back into reservoirs to maintain pressure and recover the gas.
- d. The project is backed by the Indonesian government as a national strategic initiative, playing a role in the country’s decarbonisation and energy security goals. This initiative is supported by BP’s extended exploration rights until 2025, ensuring continued development and potential expansion of CCS capabilities.

6.2. Presentation from Kawasaki Kisen Kaisha, Ltd. (K-LINE)

Jun Sasaki, General Manager, Carbon Solution Business Group, from K-LINE, presented “K’ LINE’s Initiatives on LCO₂ Transportation for CCS”. The Workshop noted the following highlights:

- a. K-Line, a Japanese shipping company with over 450 vessels, aims to lead in CO₂ transport through marine shipping as part of its decarbonisation strategy. With goals to cut CO₂ emissions by 2050, K-Line is transitioning from heavy oil to greener ship fuels and supporting societal decarbonisation through hydrogen, ammonia, offshore wind, and CO₂ transport.
- b. Marine transport becomes more economical than pipelines for distances over 200 km, which is crucial for CCS in the Asia-Pacific region where oceanic distances are vast. K-Line estimates that 200 ships will be needed by 2030 to meet the demand for CO₂ transport.
- c. K-Line sees a complementary relationship between LNG and CO₂ transport, which is vital for energy security and decarbonisation, especially in the energy-trading-heavy Asia-Pacific region. This synergy supports both the company’s and the region’s decarbonisation goals.
- d. K-Line is involved in the Northern Lights project in Norway and Japan’s NEDO project, focusing on CO₂ transport using different temperature-pressure methods to optimise both long and short-distance transport. These projects highlight K-Line’s commitment to advancing CO₂ transport technologies and supporting global CCS initiatives.

6.3. Presentation from Shell

Afiq Rahmat, Energy Transition Manager, Malaysia, from Shell, presented “Towards an Inter-Operable CCS Value Chain in Asia”. The Workshop noted the following highlights:

- a. CCS is central to Shell's strategy for reducing Scope 1 emissions, alongside producing low-carbon products and renewable energy. This strategy aims to help various sectors like gas and hydrogen decarbonise. Shell views the Asia-Pacific region as a significant CCS market, with key areas for developing large-scale CCS projects in Malaysia, Brunei Darussalam, and Australia.
- b. Shell emphasises the importance of standardising CCS technology to reduce costs, particularly in storage assessment, transport, and well design. They aim to apply best practices from global projects like Northern Lights and Quest to achieve this standardisation.
- c. Shell has developed proprietary CCS technologies like CanSolv, a carbon capture system that uses a regenerable amine to capture up to 99% of CO₂ from low-pressure, oxidised gas streams, which are deployed globally. Their projects in Europe and Canada serve as successful models for long-term CCS operations, demonstrating the effectiveness and scalability of their technologies.
- d. Collaboration between industry and government is key to the success of CCS. Shell is focused on building a viable business case for CCS while addressing regulatory challenges, particularly for transboundary projects. This collaborative approach is essential for overcoming obstacles and ensuring the successful implementation of CCS initiatives.

6.4. Presentation from Mitsubishi Heavy Industries (MHI)

Taichi Tanaka, Engineering Manager from MHI, presented "MHI's Efforts to Develop Effective and Economic CO₂-Value Chain". The Workshop noted the following highlights:

- a. MHI aims for carbon neutrality by 2040 through its "Mission Net Zero" program launched in 2021. Leveraging its 140-year history and technological expertise, MHI is a key player in CCUS, with CO₂ capture technology capable of handling around 5,000 tonnes of CO₂ per day. MHI is involved in nine CCS projects across Japan.
- b. MHI contributes to standardising CCS infrastructure and making large-scale CO₂ transport economically feasible. By leveraging its experience in LNG, MHI drives cost-efficiency in CCS projects, ensuring that large-scale liquified CO₂ transport via shipping becomes more viable.
- c. MHI collaborates with key industry partners to advance the CCS value chain and standardise technologies, with a particular focus on the Asia-Pacific region. For example, MHA is partnering with startup companies such as Infinium to work on the utilisation of CO₂.
- d. Based on the timeline of each of MHA's activities, MHA's believes that the period from 2024 to 2026 is a very important period in which various activities need to be undertaken in parallel. Harmonising each activity is also needed. MHI aims to strengthen collaborations, advance technology, and contribute to global decarbonisation goals, playing a significant role in the global effort to reduce CO₂ emissions.

6.5. Presentation from Chevron

David Fallon, General Manager from Chevron, presented "CO₂ Specifications for CCS Storage". The Workshop noted the following highlights:

- a. Gorgon project, led by Chevron in partnership with Shell and Exxon, has successfully stored over 10 million tonnes of CO₂. At Gorgon, CO₂ is captured at

99.5% purity, requiring minimal treatment beyond drying, though even minor contaminants pose risks during storage and transport. Lessons from this project are shared to guide future CCS initiatives.

- b. The project faced challenges during the start-up and shutdown phases, particularly with CO₂ batch transportation and managing moisture content in pipelines. These operational hurdles highlight the complexities involved in CO₂ transport.
- c. Chevron emphasises the importance of ensuring CO₂ remains supercritical to avoid overburdening emitters with costs while maintaining safety. This balance ensures that CCS projects remain both practical and economically viable.
- d. International regulations, such as those under the London Protocol, pose challenges for Gorgon's compliance, especially with handling contaminants in mixed CO₂ streams. Industry-government dialogue is essential for setting workable standards to address these regulatory hurdles.

6.6. Presentation from PETRONAS

Christopher K Singham, Head of Carbon Capture Technologies from Petronas, presented "Advancing Malaysia's Decarbonisation: Integrating Carbon Capture Technology, Utilisation & Storage". The Workshop noted the following highlights:

- a. Petronas has formed the "Carbon Avengers" coalition, including partners like MISC, Honeywell UOP, and TechnipFMC, to address the complexities of the CCUS value chain in Southeast Asia. This coalition is driving several pilot projects to deploy CCUS technologies across the region. Petronas is leading projects like the Project Carbon Strike, simplifying the carbon capture process by managing the entire back-end value chain for emitters.
- b. The company is piloting innovative technologies such as Rotating Packed Bed Technology, which aims to miniaturize distillation columns and contacting towers, making them smaller and more compact. Additionally, the company is testing Membrane Contactor (MBC) technology, a hybrid process that combines membranes with solvent separation technologies to optimise CO₂ capture solutions for onshore applications. MBC is being tested in Canada due to its low cost and capital expenditure (CAPEX) effectiveness.
- c. Petronas's CCUS efforts align with Malaysia's National Energy Transition Roadmap (NETR) and National Investment Management Plan (NIMP). The company is collaborating with steel, petrochemical, and cement industries to explore decarbonisation strategies, particularly in response to mechanisms like the Carbon Border Adjustment Mechanism (CBAM). However, CCS remains expensive at present.
- d. Although CCS may not become viable in some regions by 2029-2030, Petronas is focusing on carbon capture and utilisation in the meantime. Through Project Carbon Strike, the company aims to simplify the CCUS process and make it more accessible. The commercial deployment of MBC technology in Canada is a significant milestone towards scaling up.
- e. Petronas is positioning itself as a leader in CCUS for Southeast Asia through strategic partnerships and innovations. The company's long-term goal is to reduce the complexity and cost of CCUS, ensuring it becomes a sustainable and viable solution for industries, contributing to both global climate goals and economic stability.

6.7. Panel Discussion

Alex Zapantis, General Manager, External Affairs, from the Global CCS Institute, moderated the Panel Discussion. The Workshop noted the following highlights from the discussion:

- a. **CO₂ Pipeline and Storage, and Elevated Pressure Technology:** In the U.S., there are approximately 8,000 kilometres of CO₂ pipelines, typically extending a few hundred kilometres each. CO₂ is injected at depths greater than 800 meters to maintain a dense or supercritical state, with common depths ranging from 2 to 3 kilometres. Pipeline diameters are economically determined, with 12-inch pipelines being common for capacities up to 1 million tonnes per year. Elevated Pressure (EP) technology, similar to Compressed Natural Gas (CNG) technology, is best suited for short-distance CO₂ transportation where pipelines are not feasible. While it has potential, EP is considered a niche solution due to its limited applicability and has not yet been fully standardised in the CO₂ shipping value chain.
- b. **Enhanced Gas Recovery and Storage Options:** Enhanced gas recovery through CO₂ injection, as seen in Tangguh, aims at maintaining pressure and sweeping gas, but the overall increase in gas recovery is modest, less than 3%, due to its application in a field that is not fully depleted. Saline aquifers offer the advantage of proximity to injection sites, reducing pipeline costs. However, depleted oil and gas fields may present challenges due to the numerous existing wells, which could be potential leakage points requiring remediation. The choice between these storage options depends on specific project circumstances.
- c. **Commercial Considerations and CO₂ Specifications for Shipping:** The CO₂ shipping value chain from South Korea to Malaysia is expensive, with costs potentially reaching US\$200 per tonne. Factors like emitter proximity, project timelines, and ship replacement after 20 years influence these costs. Reducing costs may involve finding synergies in storage and shared terminals. There are ongoing discussions about the quality of CO₂ captured from ship emissions, which may differ from industrial sources like cement and power plants. Proper CO₂ specifications are crucial, especially for onboard carbon capture technologies, to ensure safe handling and sequestration.
- d. **Business Models and Strategic Importance of CCS Projects:** The best business model for CCS projects depends on a company's strengths and risk management capabilities. Collaboration across the value chain is essential, with different players managing different risks and returns. Models like Production Sharing Contracts (PSC) can be effective, as seen in Indonesia, where CCS is now recognised as part of petroleum operations. The strategic importance of CCS involves reducing the complexity and cost of CCUS, ensuring it becomes a sustainable and viable solution for industries, and contributing to both global climate goals and economic stability.

SESSION 7: INTERNATIONAL SUPPORT AND INVESTMENT

7.1. Presentation from World Bank

Dr Harshit Agrawal, Senior Energy Specialist from The World Bank, presented "Challenges and Enablers to Finance CCS projects". The Workshop noted the following highlights:

- a. CCS is vital for achieving global climate targets and transitioning to low-carbon energy, especially in developing countries. It helps industrialise along a lower carbon pathway, maintain jobs in hard-to-abate sectors, and monetise geology for carbon storage. However, barriers include high upfront costs, limited business cases for non-Enhanced Oil Recovery CO₂ storage, low technology transfer, data gaps on storage capacity, and lack of guidance for cross-border CO₂ transport and offshore storage.
- b. The World Bank's strategy is multifaceted. In the short term, it focuses on market-enabling advisory work in countries like Nigeria, South Africa, Vietnam, Timor-Leste, and Indonesia. Medium-term plans involve exploring risk mitigation and investment opportunities in regions with supportive regulatory environments. There is significant interest in Asia Pacific countries, with a focus on addressing challenges related to transboundary CO₂ transport and storage.
- c. The World Bank identifies four critical factors for successful CCS projects:
 - **Technical Feasibility:** Understanding suitable storage sites and efficient value systems.
 - **Cost-Effectiveness:** Focusing on sustainable business models for large capital investments.
 - **Proper Regulations:** Developing legal frameworks and Monitoring, Reporting, and Verification (MRV) systems.
 - **Support from Local Communities:** Emphasising the importance of collaboration and knowledge sharing for social acceptance of CCS projects.
- d. The World Bank aims to support CCS development along the entire value chain through both advisory and investment services. This includes providing technical and economic advisory support for hard-to-abate sectors, facilitating the development of cross-border CO₂ transportation and storage infrastructure, and offering risk mitigation services and political risk coverage through various World Bank Group institutions.

7.2. Presentation from ADB

Atsumasa Sakai, Senior Energy Specialist from the Asian Development Bank (ADB), pre-recorded the presentation on "ADB's Support to Hard-to-Abate Sectors". The Workshop noted the following highlights:

- a. The Asian Development Bank (ADB) has committed US\$100 billion in climate finance by 2030, positioning itself as the Asia and Pacific Climate Bank. ADB is expanding support to decarbonise hard-to-abate sectors like steel, chemicals, cement, water reservoirs, and refineries, which face unique emission reduction challenges.
- b. ADB is exploring solutions such as carbon capture, energy efficiency improvements, transportation innovations, green hydrogen utilisation, and innovative processing measures. In China, ADB has supported projects to improve energy efficiency in chemical plants and steel industries, pilot hydrogen fuel cells in public transport, and finance a carbon capture facility with a 10,000-tonne annual CO₂ capacity.
- c. ADB is launching new activities in countries like India, the Philippines, and Turkmenistan, focusing on technical solutions like green steel production. Since 2009, ADB has supported over 20 CCUS projects, including capacity building, developing research centres, and producing knowledge products.

- d. Successful CCUS deployment requires continuous government engagement, dedicated research and development organisations, and government investment in technology. ADB offers support throughout the CCUS value chain, from planning to implementation, including technical assistance and various financing products like the Contingent Recovery Grant, which can provide up to US\$10 million or 10% of project costs.

7.3. Presentation from JOGMEC

Kazuki Kobayashi, Researcher, Planning Division, CCS Project Department, from the Japan Organisation for Metals and Energy Security (JOGMEC), presented “Transborder CCS and Joint Crediting Mechanism (JCM)”. The Workshop noted the following highlights:

- a. JOGMEC has expanded its functions to include financial assistance for hydrogen and CCS projects, as well as geological and geophysical services for CCS. This expansion supports Japan’s goal of carbon neutrality by 2050. JOGMEC introduced three types of CCS projects: domestic CCS, Joint Crediting Mechanism (JCM), and cross-border CCS, each with different implications for emissions accounting and international cooperation.
- b. JCM is a bilateral offset credit mechanism that allows Japan to invest in decarbonisation projects like CCS in partner countries, sharing emission reduction credits. Cross-border CCS involves transporting CO₂ from an emitting country to a storage country, with emissions reductions attributed to the emitting country and storage fees benefiting the storage country. This approach can reduce financial risks and enhance the economics of CCS projects.
- c. Japan ratified the 2009 amendment to the London Protocol in May 2023, enabling cross-border CCS by requiring agreements between exporting and receiving countries. JOGMEC promotes regional cooperation on cross-border CCUS within the ASEAN region, signing Memorandums of Cooperation (MOCs) with organisations like the ASEAN Centre for Energy (ACE) and participating in initiatives like the Asia Zero Emissions Community (AZEC).
- d. JOGMEC provides technical assistance and financial services and engages with public and private funds and insurance companies to support CCS projects. They have published guidelines and handbooks on CCS to support regional and global carbon neutrality efforts. Additionally, JOGMEC highlighted an innovative private financing option called the Contingent Recovery Grant, offering grants up to US\$10 million or 10% of project costs.

7.4. Panel Discussion

Matt Steyn, Public Affairs Manager APAC, from the Global CCS Institute, moderated the Panel Discussion. The Workshop noted the following highlights from the discussion:

- a. **Joint Crediting Mechanism (JCM) and CCS:** The panel highlighted that while the JCM scheme exists, CCS methodology is not yet included. For CCS to be covered, agreements between the JCM secretariats of both partner countries and Japan are required, indicating the need for further development and negotiations.
- b. **Cross-border CCS and Leakage Responsibility:** Managing potential leakage is crucial for cross-border CCS projects. In Government-to-Government (G2G) contexts, the storage country bears leakage responsibility as per IPCC

guidelines. For Business-to-Business (B2B) contexts, leakage mitigation strategies should be specified in contracts, ensuring comprehensive risk management.

- c. **Public-Private Partnerships and Financial Support:** Dr Agrawal emphasised the importance of public-private partnerships for transnational CCS projects, highlighting the need for government support in risk mitigation. The World Bank supports CCS projects with various financial instruments, including grant funding, pilot demonstrations, risk mitigation services, and involvement in full-scale projects.
- d. **Education, Community Support, and Post-Closure Monitoring:** Education and community support are critical for advancing CCS projects. The World Bank focuses on capacity building and knowledge sharing, particularly in developing countries. Post-closure monitoring guidelines are expected to be released soon, emphasising the long-term considerations necessary for successful CCS implementations.

SESSION 8: WORKSHOP CONCLUDES

8.1. Closing Remarks

Alex Zapantis, General Manager of External Affairs at the Global CCS Institute, delivered closing remarks for the 3rd SEACA Workshop. He highlighted the success of the Workshop in uniting a diverse range of participants from both the private and public sectors. He emphasised the importance of discussions on serving the economic and climate ambitions of the ASEAN region through CCS. Additionally, he noted the significance and urgency of addressing the transnational value chain, a topic that was chosen for this workshop for its current popularity and the substantial ongoing developments in this area. Alex extended gratitude to ANGEA and the ASEAN Centre for Energy for their continued assistance in co-organising the Workshop. He also thanked the Malaysian government for their excellent hosting arrangements and support, noting the productive discussions with local CCS industry representatives.

*****End of Report*****

ANNEX 1 – AGENDA

DAY 1: TUESDAY 27 AUGUST 2024 - Grand Ballroom 1, Renaissance KL Hotel s Convention Centre Kuala Lumpur, Malaysia			
SESSION	TIME (MYT)	Min	SPEAKER
WELCOME	8:30 – 9:15	30	Registration and Networking Check-in, collect your badge, and enjoy tea and coffee while mingling with fellow delegates.
1. OPENING	Presentations from the host country, partners, sponsors, and the event hosts.		
	9:20 - 9:30	10	Part III: Creating a Transnational Asian CCS Value Chain Alex Zapantis, General Manager, External Affairs - Global CCS Institute Welcome remarks and an overview of the day's agenda
	9:30 - 9:40	10	Malaysian Government - Ministry of Economy YBhg. Dato' Luqman bin Ahmad, Secretary-General
	9:40 - 9:50	10	ASEAN Centre for Energy Beni Suryadi, Deputy Executive Director
	9:50 - 10:00	10	ERIA (Economic Research Institute for ASEAN and East Asia) Phoumin Han, Senior Energy Economist Southeast Asia Potential for the CCS/CCUS Hub: Opportunities and Challenges
	10:00 - 10:10	10	ANGEA (Asia Natural Gas s Energy Association) Paul Everingham, CEO CCUS: Policy Enabler for a Regional Value Chain
	10:10 - 10:20	10	Global CCS Institute Alex Zapantis, General Manager, External Affairs Overview of CCS in SE Asia – Opportunities C Challenges
	10:20 - 10:30	10	MOU Signing Ceremony: ASEAN s ANGEA Group Photo
	10:30 - 11:00	30	MORNING TEA
2. OPPORTUNITY FOR AN ASIAN CCS VALUE CHAIN	Issues may include the opportunity for each nation to provide CO ₂ storage services or the need to export CO ₂ to other nations for storage, a summary of current activities and projects, the key issues that must be successfully addressed from a government perspective to enable the creation of an Asian CCS Value Chain to support the achievement of net zero emission targets, and thoughts on how to address those issues.		
	11:00 - 11:10	10	Australia Naomi Montalto, Assistant Director, Transboundary CCS Section, DCCEEW Australia's Role in Regional Decarbonisation
	11:10 - 11:20	10	Indonesia Bobby Permanahadi, Senior Oil and Gas Policy Analyst, Ministry of Energy and Mineral Resources of Indonesia The Opportunities on CCS Implementation in Indonesia: Collaborating CCS Ecosystem in South East Asia
	11:20 - 11:30	10	Malaysia Dr. Noranida Zainal, Director, Environmental and Natural Resources, Ministry of Economy
	11:30 - 11:40	10	Singapore Cui Xiao Wen, Ministry of Trade and Industry Singapore, Deputy Director (Carbon Mitigation) Singapore's Plans for CCS and The Next Steps
	11:40 - 11:50	10	Thailand Dr. Apiradee Suwannathong, Senior Geologist, Department of Mineral Fuels, Ministry of Energy of Thailand The Current Status of CCS Development in Thailand
	11:50 - 12:00	10	South Korea Eunsoo Jung, General Manager of Policy C Planning Division, Korea CCUS Association CCUS Policy and Roadmap of Korea
	12:00 - 12:10	10	Japan Makoto Kunieda, Deputy Director, Advanced CCS Project Division, CCS Project Department, Japan Organization for Metals and Energy Security (JOGMEC) Results of the second round of Japan's financial support for commercialization of CCS projects
	12:10 - 12:20	10	Timore-Leste Luzerio Teme, CCS Coordinator in the CCS division of the Ministry of Petroleum and Mineral Resources Future Outlook for CCS in Timor-Leste: Vision and Challenges
		12:25 - 12:55	30
	13:00 - 14:00	60	LUNCH
3. INTERNATIONAL LAW	This session will focus on international law relevant to the transboundary transport of CO ₂ for geological storage. Relevant international treaties or laws such as the London Convention will be discussed together with how critical issues such as the long-term liability for stored CO ₂ are treated under international law.		
	14:00 - 14:15	15	Allen s Overy Shearman Scott Neilson, Partner Going Beyond the London Protocol: New G2G and B2B Agreements Underpinning CCS Projects
	14:15 - 14:30	15	Ashurst Guy Dwyer, Partner Translating International Law Considerations for Transboundary CCS Projects Into Domestic Law: Risks and Opportunities
	14:30 - 14:45	15	IEAGHG Tim Dixon, General Manager, IEA Greenhouse Gas RCD Programme London Protocol (and IPPC) on Transboundary CCS Projects
	14:45 - 15:00	15	Panel Discussion <i>Moderated by Ian Havercroft, General Manager, Knowledge & Analysis, Global CCS Institute</i>

DAY 1: TUESDAY 27 AUGUST 2024 - Grand Ballroom 1, Renaissance KL Hotel s Convention Centre Kuala Lumpur, Malaysia			
SESSION	TIME (MYT)	Min	SPEAKER
4. BILATERAL AND MULTILATERAL AGREEMENTS	International trade in CO ₂ storage services will require government-to-government agreements addressing issues including the regulation of CO ₂ storage, transfer of ownership and liability, and how national carbon accounts will be managed. This session will enable project developers to share their perspectives on these agreements, and how they impact projects including for example how they may interact with commercial contracts.		
	15:30 - 15:40	10	ExxonMobil Corporation Casey Delhotal, Senior Director, International Government Relations, Asia Pacific Recommendation to Policy Makers for Cross-border CCS agreements
	15:40 - 15:50	10	Santos Ltd Matthew Sherwell, Senior Manager Regulatory C Market Development Agreement or Arrangement - options to meet the provisional application of Article 6 amendment
	15:50 - 16:00	10	Shell Sue-Ern Tan; Head Policy and Advocacy Asia Pacific Bilateral Agreements – Lynchpin for an APAC CCS Value Chain
	16:00 - 16:10	10	Air Liquide Floriss Mackor, Large Industries VP Strategy CCS and Ammonia Challenges C Achievements of Cross-Border Agreements
	16:10 - 16:20	10	Mitsui O.S.K. Lines, Ltd. (MOL) Sony Rajan, General Manager, CCUS Business Development Team MOL's Initiatives for Cross-Border CO ₂ Transportation and CCUS
	16:20 - 16:30	10	Petronas Lou Khee Fang, CCS Project Management Head
	16:30 - 17:00	30	Panel Discussion <i>Moderated by Alex Zapantis, General Manager, External Affairs, Global CCS Institute</i>
GALA DINNER	18:30 – 21:30	120	Grand Ballroom 1 Renaissance KL Hotel C Convention Centre <i>An opportunity to network with fellow delegates in a relaxed setting.</i> Dress Code: Traditional or Smart Casual

DAY 2: WEDNESDAY 28 AUGUST 2024 - Grand Ballroom 1, Renaissance KL Hotel s Convention Centre Kuala Lumpur, Malaysia			
SESSION	TIME (MYT)	Min	SPEAKER
WELCOME	8:00 – 8:30	30	Registration and Networking Check-in, collect your badge, and enjoy tea and coffee while mingling with fellow delegates.
5. CARBON ACCREDITATION FOR CCS PROJECTS	The recognition and monetisation of abatement from any activity, including CCS require rigorous, transparent, and verifiable methods to calculate abatement delivered. This session will focus on methods and carbon accounting requirements relevant to an international Asian CO ₂ storage value chain, including the creation and ownership of carbon credits.		
	9:00 - 9:20	20	IETA Takashi Hongo, Senior Fellow, Mitsui C Co. Global Strategic Studies Institute, and Co-chair of Japan WG, IETA Accounting and Sustainability for Monetization of CCS
	9:20 - 9:40	20	Mitsubishi Research Institute, Inc (MRI) Tetsuya Nomoto, Senior Researcher Positioning Carbon Capture Storage (CCS) in Carbon Pricing to Decarbonise in ASEAN
	9:40 - 10:00	20	ExxonMobil Corporation Casey Delhotal, Senior Director, International Government Relations Asia Pacific Pathways to Credits for Cross Border CCS
	10:00 - 10:30	30	Panel Discussion <i>Moderated by Hanh Le, Advisor, ANGEA</i>
	10:30 - 11:00	30	MORNING TEA
6. TECHNICAL, OPERATIONAL s INFRASTRUCTURE REQUIREMENTS	The transport and subsequent storage of CO ₂ requires significant infrastructure that must be designed and operated to ensure safety and efficiency. Further, the CO ₂ itself will need to meet certain requirements. This session will explore these requirements including how common standards could be applied to support an Asian CCS Value Chain.		
	11:00 - 11:15	15	BP Asia Pacific Zulfikri Agus, Performance Manager Tangguh CCUS: An Indonesian National Strategic Project
	11:15 - 11:30	15	Kawasaki Kisen Kaisha, Ltd. (K-LINE) Jun Sasaki, General Manager, Carbon Solution Business Group "K"LINE's Initiatives on LCO ₂ Transportation for CCS
	11:30 - 11:45	15	Shell Afiq Rahmat Energy Transition Manager Malaysia Towards an Inter-Operable CCS Value Chain in Asia
	11:45 - 12:00	15	Mitsubishi Heavy Industries (MHI) Taichi Tanaka, Engineering Manager MHI's Efforts to Develop Effective and Economic CO ₂ -Value Chain
	12:00 - 12:15	15	Chevron David Fallon, General Manager CO ₂ Specification for CCS Storage
	12:15 - 12:30	15	Petronas Christopher K Singham, Head of Carbon Capture Technologies Advancing Malaysia's Decarbonisation: Integrating Carbon Capture Technology, Utilisation C Storage
	12:30 - 12:45	30	Panel Discussion <i>Moderated by Alex Zapantis, General Manager, External Affairs, Global CCS Institute</i>
	12:45- 13:45	60	LUNCH

DAY 2: WEDNESDAY 28 AUGUST 2024 - Grand Ballroom 1, Renaissance KL Hotel s Convention Centre Kuala Lumpur, Malaysia

SESSION	TIME (MYT)	Min	SPEAKER
7. INTERNATIONAL SUPPORT AND INVESTMENT	International collaboration and investment in CCS in Asia will be essential to support the creation of a CCS Value Chain in the region. Speakers in this session will describe the relevant activities of their organisations for support, financing, and investment in CCS in South East Asia.		
	13:45 - 14:00	15	The World Bank Assistance Dr. Harshit Agrawal, Senior Energy Specialist, The World Bank
	14:00 - 14:15	15	Asian Development Bank Program Atsumasa Sakai, Senior Energy Specialist, Asian Development Bank (ADB) ADB's Support to Hard-to-Abate Sectors
	14:15 - 14:30	15	Japanese Initiative Kazuki Kobayashi, Researcher, Planning Division, CCS Project Department, Japan Organization for Metals and Energy Security (JOGMEG) Transborder CCS and Joint Crediting Mechanism (JCM)
	14:30 - 15:00	30	Panel Discussion <i>Moderated by Matt Steyn, Public Affairs Manager APAC, Global CCS Institute</i>
15:00 - 15:15 WORKSHOP CONCLUDES	15	Closing Remarks Alex Zapantis, General Manager, External Affairs - Global CCS Institute We will conclude the workshop with a summation of the 2 days.	

ANNEX 2 – REGISTRATION LIST

Name	Title	Company	Country
Guy Dwyer	Partner	Ashurst	AUSTRALIA
Alex Yelland	Director Policy & Advocacy	Asia Natural Gas & Energy Association	AUSTRALIA
Hanh Le	Advisor	Asia Natural Gas & Energy Association	AUSTRALIA
Laila Nowell	Chief of Staff	Asia Natural Gas & Energy Association	AUSTRALIA
Paul Everingham	Chief Executive	Asia Natural Gas and Energy Association	AUSTRALIA
Ken Xie	First Secretary	Australian High Commission	AUSTRALIA
Rumana Juzar	Investment Officer	Australian High Commission	AUSTRALIA
Lachlan McPhee	Second Secretary	Australian High Commission, Kuala Lumpur	AUSTRALIA
Juliana Badlie	Country Manager - Trade and Investment	Australian Trade and Investment Commission	AUSTRALIA
Naomi Montalto	Assistant Director, Transboundary CCS Section	Department of Climate Change, Energy, the Environment and Water	AUSTRALIA
Melanie Shannon	Assistant Director	Department of Foreign Affairs and Trade	AUSTRALIA
Alex Zapantis	General Manager External Affairs	Global Carbon Capture and Storage Institute	AUSTRALIA
Christina Staib	Global Finance Impact Lead	Global CCS Institute	AUSTRALIA
Aishah Hatta	Senior Storage Lead	Global CCS Institute	AUSTRALIA
Hiroshi Nambo	Branch Representative - Japan	Global CCS Institute	AUSTRALIA
Ian Havercroft	General Manager Knowledge and Analysis	Global CCS Institute	AUSTRALIA
Matt Steyn	Manager Public Affairs, APAC	Global CCS Institute	AUSTRALIA
Preeta Panicker	Senior Events & Communications Lead APAC	Global CCS Institute	AUSTRALIA
Sarah Hardman	Regional BD Manager - APAC	Global CCS Institute	AUSTRALIA
Neil Kingsbury	Managing Legal Counsel	INPEX Australia	AUSTRALIA
Howard Smith	Director Industrial Ecology Development	Northern Territory Government	AUSTRALIA
Ernest Yap	Engineering Lead	NT Department of Infrastructure, Planning and Logistics	AUSTRALIA
Matt Sherwell	Senior Manager Regulatory & Market Development	Santos	AUSTRALIA
Ben Jury	CCS Opportunity Manager APAC	Woodside	AUSTRALIA
Avtar Dhaliwal	Business Development Manager	Woodside Energy	AUSTRALIA
Vang Vibol	Deputy Chief of Office	Department of Cooperation and ASEAN Affairs, Ministry of Mines and Energy	CAMBODIA
Year Chansaravuth	Deputy Director	Ministry of Mines and Energy	CAMBODIA
Beni Suryadi	Manager	ASEAN Centre for Energy	INDONESIA
Lintang Ambar Pramesti	Junior Research Analyst	ASEAN Centre for Energy	INDONESIA
Shania Manaloe	Research Analyst	ASEAN Centre for Energy	INDONESIA
Suwanto	Senior Research Analyst	ASEAN Centre for Energy	INDONESIA
Zulfikri Agus	Subsurface Interface Manager	bp Asia Pacific	INDONESIA
Wijaya Kusuma Dewi Sitohang	Oil and Gas Inspector	Directorate General of Oil and Gas MEMR Republic of Indonesia	INDONESIA
Bobby Permanahadi	Senior Oil and Gas Policy Analyst	Directorate General of Oil and Gas, MEMR	INDONESIA
Phoumin Han	Senior Energy Economist	ERIA (Economis Research Institute for ASEAN and East Asia)	INDONESIA
Evan Lukas Satya karmendra	Policy regulatory development director	ExxonMobil Low Carbon Solution	INDONESIA
Muhamad Prawira	Associate Investment Officer	IFC	INDONESIA
Belladonna Maulianda	Executive Director of Indonesia CCS Center	Indonesia CCS Center	INDONESIA
Diofanny Putri	Head of Business Development	Indonesia CCS Center	INDONESIA
Rizky Kahfie	Secretary General	Indonesia CCS Center	INDONESIA
Amedea Amanda Bais	Analyst of Oil and Gas Cooperation	MEMR	INDONESIA
Ridwan Kurniawan	UK PACT ASEAN GTF - Senior Engagement Lead	Palladium International	INDONESIA
Dudhi Hamdhi	Sr Commercial Low Carbon Tech	Pertamina	INDONESIA
Baginda Saragih	Manager Portfolio I	Pertamina Persero	INDONESIA

Name	Title	Company	Country
Mikiya Yamashita	Specialist for Research and Development	Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry	JAPAN
Mao Shimoda	Business Development Analyst	INPEX	JAPAN
Yutaro Takamori	Commercial Coordinator	INPEX Corporation	JAPAN
竜太 萩原	Manager, Business Strategy Group, Hydrogen & CCUS	INPEX Corporation	JAPAN
Kazuki Kobayashi	Researcher	JOGMEC	JAPAN
Makoto Kunieda	Project Director	JOGMEC	JAPAN
Yoshitake Kato	Assistant General Manager	JOGMEC	JAPAN
Jun Sasaki	General Manager, Cargon Solution Business Group	Kawasaki Kisen Kaisha, Ltd.	JAPAN
Asuka Hayashi	CCS Business team, Carbon Solution Business Group	Kawasaki Kisen Kaisha, Ltd. ("K" LINE)	JAPAN
Teppei Takahashi	Senior Vice President	Mitsubishi Heavy Industries Asia Pacific Pte. Ltd.	JAPAN
Hidekazu Shibuya	Manager, Leader of CCUS taskforce, GX Business Dev	Mitsubishi Heavy Industries, Ltd	JAPAN
Taichi Tanaka	Engineering Manager	Mitsubishi Heavy Industries, Ltd.	JAPAN
Tetsuya Nomoto	Senior Researcher	Mitsubishi Research Institute, Inc	JAPAN
Takashi Hongo	Senior Fellow	Mitsui & C. Global Strategic Studies Institute	JAPAN
Sony Rajan	General Manager, CCUS Business Development Team	Mitsui O.S.K. Lines, Ltd	JAPAN
Aoi Taniyama	Senior Coordinator	Mitsui O.S.K. Lines, Ltd.	JAPAN
Souksavanh Sodlamany	Tactical Officer	Department of Planning and Cooperation, MOFA Lao PDR	LAO PDR
Vilaythong AEMIXAY	Deputy Director of Center	Research Institute for Energy and Mines	LAO PDR
Amirah Ahmad	Senior Trade Manager for Clean Growth	British High Commission Kuala Lumpur	MALAYSIA
Nicholas Chan	Climate Diplomacy Advisor	British High Commission Kuala Lumpur	MALAYSIA
Christina Sevajee	VP Technology	Bumi Armada	MALAYSIA
Amirulazry Bin Mohd Amin	Assistant Director	Energy Commission	MALAYSIA
Helmi Zaihan	Deputy Director	Energy Commission	MALAYSIA
Aiman Bin Zainurin	Assistant Director	Energy Commission	MALAYSIA
Sim Chuen hoeng	HOD	Essem corporation sdn bhd	MALAYSIA
Sukiman Mohamed	Senior Advisor	ExxonMobil Exploration and Production Malaysia Inc	MALAYSIA
Dr. Vasu Swami	Asia Partnerships Director Carbon Solutions	GE Vernova	MALAYSIA
Krishnakumar Pg	Engineering Director	GEV	MALAYSIA
Noranida Zainal	DIRECTOR	Government	MALAYSIA
Nurzalina Binti Jamaluddin	Head, Decarbonization	Hibiscus Petroleum	MALAYSIA
Keat Siang (KS) Goh	Director, Investments	Khazanah Nasional Bhd	MALAYSIA
Aidil Iman Aidid	Policy Research Intern	Khazanah Research Institute	MALAYSIA
Farhana Shukor	Research Associate	Khazanah Research Institute	MALAYSIA
Mohd HANAFI Jamal	Senior Advisor	KLINE MARINE & ENERGY PT LTD	MALAYSIA
Er Loon Khoo	Business Development	Ministry of Economy	MALAYSIA
Irene Chung	Assistant Director	Ministry of Economy	MALAYSIA
Nik Nor Aiza Nik Abdul Aziz	Principal Assistant Director	Ministry of Economy	MALAYSIA
Nik Zarifah Anis Abdul Aziz	Deputy Head CCUS Coordination Unit	Ministry of Economy Malaysia	MALAYSIA
Michel Azlir	Senior Manager Business Development, New Energy	MISC	MALAYSIA
Ailina Razali	Senior Manager Business Development, New Energy	MISC Berhad	MALAYSIA
Junto Endoh	Chief Country Representative, Malaysia	Mitsui O.S.K. Lines, Ltd.	MALAYSIA
Amir Hisham Albakri	Executive Committee Member	MOGSC	MALAYSIA

Name	Title	Company	Country
Ilham Sunhaji	VP	MPRC	MALAYSIA
Ann Nathashia Pelaga Mathiew Paran	CCUS Regulatory and Governance Specialist	Petroleum Sarawak Berhad (PETROS)	MALAYSIA
Amirah Safiya Azhar	Senior Legal Associate	PETROLIAM NASIONAL BERHAD	MALAYSIA
Sarah Afandi	Technical Sales	Petroliam Nasional Berhad	MALAYSIA
Ahmad Amirul Arif Bin Mohd Azalan	Team Member (Technology Digital Business)	Petroliam Nasional Berhad (PETRONAS)	MALAYSIA
Akmal Ramlel	Legal Counsel	PETROLIAM NASIONAL BERHAD (PETRONAS)	MALAYSIA
Nur Najihah Zesdyzar	Senior Legal Associate	Petroliam Nasional Berhad (PETRONAS)	MALAYSIA
Azlan Mustafa	Senior Reservoir Engineer	PETRONAS	MALAYSIA
Christopher Singham	Head of Carbon Capture Technology and Solutions	PETRONAS	MALAYSIA
Eda Rahayu Bakar	Senior Manager, Corporate Strategy	Petronas	MALAYSIA
Farouk Ramli	Legal Counsel	PETRONAS	MALAYSIA
Hartini Mohd Aris	Manager Portfolio Upstream & Corporate	PETRONAS	MALAYSIA
Keirrthana Jothy	BD	PETRONAS	MALAYSIA
Khee Fang Lou	Senior Manager, CCS Project Management	PETRONAS	MALAYSIA
Mohd Amri Mohd Diah	Principal Reservoir Geoscience	PETRONAS	MALAYSIA
Nanthini Raman	Technical Engineer	Petronas	MALAYSIA
Phoebe Sim	Commercial Analyst	PETRONAS	MALAYSIA
Sabarina Samadi	Senior Legal Counsel	PETRONAS	MALAYSIA
Shamini Indrasanan	Partnership Manager	PETRONAS	MALAYSIA
Naeem Hussaini Norazli	Senior Legal Associate	Petronas Holdings (petroliam Nasional Berhad)	MALAYSIA
Nazrin Banu Shaikh Sajjad Ahmad	SVP SRM	PETROS	MALAYSIA
Ely Raziah Abdul Rashid	Lead Advisor, Country Manager's Office	PTTEP	MALAYSIA
Natthaphong Sirijirasuk	Head of Legal and Country Manager Office Section	PTTEP	MALAYSIA
Noorhamimah Baseri	Head of Legal	PTTEP Sarawak Oil Limited	MALAYSIA
Hana Azura	Business Development Manager	Samsung E&A	MALAYSIA
Afiq Rahmat	Energy Transition Manager	Shell	MALAYSIA
Patricia Seevam	GM Transformation & Energy Transition	Shell	MALAYSIA
Aizat Zeinuddin	Senior Manager (Strategic Sourcing)	TNB Fuel Services	MALAYSIA
Muhaz Rizal Muhamad	Senior Engineer	TNB Power Generation Sdn.Bhd.	MALAYSIA
Noraziah Muda	Head (Renewable Energy and Green Technology)	TNB Research	MALAYSIA
Mohan Gurusamy	Commercial Specialist	U.S. Embassy in Malaysia	MALAYSIA
Cameron Millard	Economic Officer	U.S. Embassy Kuala Lumpur	MALAYSIA
Aung Ko	Director, Ministry of energy	Ministry of energy	MYANMAR
San Win	Director	Ministry of Natural Resources and Environment	MYANMAR
Austria Angelou Balba	Senior Science Research Specialist	Department of Energy	PHILIPPINES
Donnabel Kuizon Cruz	Managing Director and General Manager	Prime Energy Resources Development B.V.	PHILIPPINES
Philip Ranada	Chief Legal Officer	Prime Infrastructure Capital, Inc.	PHILIPPINES
Eunsoo Jung	General Manager	Korea CCUS Association	REPUBLIC OF KOREA
Chris Park	Sr. Business Development Manager	Samsung E&A	REPUBLIC OF KOREA
Yeonghune Seo	Business Developer	Samsung E&A	REPUBLIC OF KOREA

Name	Title	Company	Country
Sunghyun (Logan)	Managing Director	SAMSUNG ENGINEERING (M) SDN BHD	REPUBLIC OF KOREA
Fabian Chin	Business Development Manager	Air Liquide	SINGAPORE
Floris Mackor	VP CCS & NH3 strategy	Air Liquide	SINGAPORE
Ronald Chew	Business Development Manager (CCS)	Altera Infrastructure	SINGAPORE
Meredith Huang	Business Development Manager, Gas & Low Carbon	bp	SINGAPORE
David Fallon	GM - Energy Transition	Chevron New Energies	SINGAPORE
Rajni Yadav	Director, Corporate Affairs, Asia Pac	Chevron New Energies	SINGAPORE
Steven Saul	APAC CCUS Manager	Chevron New Energies	SINGAPORE
Casey Delhotal	Senior Director, International Govt Affairs, Asia	ExxonMobil	SINGAPORE
Jonathan Ng	Malaysia Head of Policy	ExxonMobil	SINGAPORE
Lalit Kumar	Asia Pacific CCUS Business Manager	ExxonMobil Asia Pacific Pte Ltd	SINGAPORE
Ivana Dimitrova	Regional Lead Energy and Industrial Decarbonisatio	FCDO	SINGAPORE
Jeffrey Tan	Senior Operations Officer	IFC	SINGAPORE
Dickson Yee	Senior Assistant Director	Ministry of Trade and Industry	SINGAPORE
Xiao Wen Cui	Deputy Director	MTI	SINGAPORE
Sue-Ern Tan	Head, Policy and Advocacy Asia Pacific	Shell plc	SINGAPORE
Harshit Agrawal	Senior Energy Specialist	The World Bank	SINGAPORE
Christina Angelica	Analyst	TotalEnergies	SINGAPORE
Sarah Wilson	Partner	Allen Overy Shearman Sterling (Thailand) Co., Ltd.	THAILAND
Scott Neilson	Partner	Allen Overy Shearman Sterling (Thailand) Co., Ltd.	THAILAND
Napas Na Pombejra	Partner	Baker & McKenzie Ltd.	THAILAND
Viroj Piyawattanametha	Partner	Baker & McKenzie Ltd.	THAILAND
Apiradee Suwannathong	Geologist	Department of Mineral Fuels	THAILAND
Prawat Chamchoy	Scientist, Senior Professional Level	Department of Mineral Fuels	THAILAND
Jaturong Jerdsakulboon	Senior Executive Counsel	PTT Exploration and Production Public Company Limited	THAILAND
Sawanya Opaskornkul	Legal Counselor	PTT Exploration and Production Public Company Limited	THAILAND
Sawaporn Sophanodora	Senior Legal Officer	PTT Exploration and Production Public Company Limited	THAILAND
Ana Paula Castro De Jesus Araujo	Director of Administration and Finance	Ministry of Petroleum and Mineral Resources	TIMOR-LESTE
Luzerio Donzilio Junior Da Conceicao Teme	CCS Coordinator	Ministry of Petroleum and Mineral Resources	TIMOR-LESTE
Noventino Fernandes	CCS Department (Technique)	Ministry of Petroleum and Minerals Resources (MPRM)	TIMOR-LESTE
David Jung	Business Development	ECOLOG	UNITED KINGDOM
Hung Luan Nguyen	Official	Ministry of Industry & Trade Vietnam	VIETNAM
Lam Thien Hoan	Official	Ministry of Industry and Trade Vietnam	VIETNAM

ANNEX 3 – PRESENTATION DECKS

[SEACA III Presentations 27 August 2024](#)

[SEACA III Presentations 28 August 2024](#)