# Executive Summary

The study involves knowledge-sharing and capacity-building activities conducted as part of Asia CCUS Network (ACN) Activities from July 2021 to January 2022, and research and analysis on the cost structure of a model CCUS case study in Asia.

Firstly, as described in chapter 1, the capacity-building activity was planned to instil knowledge on technologies needed in each segment of the CCUS, namely capture, transportation, utilisation, and storage. Three technical workshops were arranged where lecturers and leading academic and business experts introduced the mechanism of respective technologies and conditions required for such technologies to be feasible for the introduction. These sessions identified key technology-related issues that should be considered in planning a CCUS project. For example, regarding carbon capture technology, while proven capture technologies in chemical absorption are available, their cost competitiveness depends on the availability of land and low-cost energy due to space and energy requirements. There is growing attention to the shared use of pipelines for transport, which leads to cost reduction possibilities and a hub-and-cluster model where multiple CO2 sources and sinks are connected through a common transport mode. As for CO2 storage, technical know-how of storing in depleted oil reservoirs and saline aquifers has been gained, and tools are being developed and tested. It was also pointed out that monitoring and verification of stored CO2 is the key to cost reduction in the long run. It enables risk communication and opens the door to gaining public support. Various efforts on carbon utilisation are ongoing to use captured CO2 efficiently, including industrial application. CO2 conversion to fuels and chemicals is deemed one of the promising areas. As for their impact on climate change mitigation, fuels, such as methanol, were stressed to be the target product as displacement of fossil fuel utilisation can maximise CO2 avoidance.

Secondly, the cost of CCUS was studied through the conceptualisation of the model case study (MCS), as described in chapter 2. Through a literature survey, the study clarified cost structure and major cost components throughout the value chain of a model CCS project. The results of the study revealed that the unit cost of CCS projects in an ASEAN country is approximately US$63/t-CO2, with greater than 70% of the cost belonging to carbon capture. This is in line with assessments made in preceding studies and demands further attention when considering future actions for improving commercial viability. The study also demonstrates that some costs remain highly variable depending on local or project-specific circumstances or largely unknown, as in the case of shipping, requiring further study and consideration through a more in-depth feasibility study.

Thirdly, the study introduces an overview of the regulatory and legal framework in CCUS-leading countries and their current status in the Association of Southeast Asian Nations (ASEAN) counties, as described in chapter 3. The existing literature shows that risks outside of technology and costs are largely related to the clarification of responsibilities

of concerned parties, such as ownership, licensing, operation, monitoring, and liability, amongst others. Also, countries with advanced CCUS projects have robust regulatory frameworks that address these issues and provide clarity. The study on the regulatory framework introduced in countries with advanced CCUS projects revealed three basic approaches in developing a regulatory framework: (i) enhancing existing oil and gas regulations with the addition of CCS-specific provisions, (ii) introducing a stand-alone regulation specific to CCS, and (iii) introducing a project-specific CCS regulation. For a suitable approach towards developing a regulatory framework in the ASEAN region, the study proposes developing regional guidelines or basic principles, which each member state can follow when considering its legal options to speed up the development process and address cross-border issues. The study also demonstrates that in countries with advanced CCUS projects, policies to promote CCUS have been introduced alongside regulatory frameworks. The policy-based incentives, such as public funding for capital and operation costs and tax credits, are key factors in reducing initial investment costs while providing creditworthiness to projects to mobilise further finance and commitment from private companies. The study also proposes adopting a regional approach to formulate such policies and incentives in the ASEAN and Asian regions.

In chapter 4, the study explores a regional approach that clarifies issues to promote CCUS further. The tentative regional framework envisages that Asian countries and international and regional partners agree on basic principles for establishing a regulatory framework in each member state and plans for creating regional incentive schemes, such as regional funds and a regional carbon market. Such action will accelerate regulatory framework development while also setting the scene for developing projects that encompass national borders to combat climate change as a region.

The MCS outcomes and the consideration for developing a regional approach were presented at the knowledge-sharing workshop (chapter 5). At the workshop, a panel of experts expressed positive reactions to the idea of a regional approach. They commented that a regional approach provides trust and foundation for essential work needed to scale up CCUS – such as engagement in feasibility and demonstration studies, regional financing framework, including a regional fund and carbon market scheme – and guidelines or basic principles on developing a regulatory framework. Based on the experts' inputs, it is recommended that concerned parties join the effort of the 'Asia CCUS Collective Action Initiative (tentative)'. Through knowledge sharing, capacity building, feasibility study and demonstration, and formulation of a dedicated organisation (chapter 6), further engagement in collaborative activities – classified under the pillars of 'technology', 'business model', 'regulatory framework', 'policy', and 'finance' – would provide a great push to developing a large-scale CCUS project that would positively impact energy transition and climate change mitigation of the region.