

Executive Summary

Hydrogen is mostly produced from fossil fuels by applying natural gas reforming, low-ranked coal gasification, and water electrolysis using renewable electricity through solar photovoltaic (PV) systems and hydropower plants. Natural gas and coal are still considered important fuels in the East Asia Summit (EAS) region; natural gas is a key transition to reduce carbon dioxide (CO₂) emissions in the EAS region, but coal is still used for power generation in most of Asia. Renewable electricity should be used as a source for industry, commercial, and residential sectors, as it is more efficient than producing hydrogen. Yet, as a first step, it is better if hydrogen is produced by unused or unutilised energies.

There is much flared gas at oil and gas fields, and the waste gas flared can be recovered and used for hydrogen production. In addition, there is abundant low-ranked coal, such as lignite and brown coal, in Asia that cannot be used due to its low quality; production of hydrogen from low-ranked coal is ideal as well. Hydropower potential is great in the Association of Southeast Asian Nations (ASEAN) region, but the locations it can be produced are in isolated areas. In these places, electricity demand is low compared to generation potential, and the cost of constructing long transmission lines between these areas and urban areas is huge – therefore, hydropower plants have never be developed. Hydrogen production from hydropower and its transport to demand areas are, however, possible. Thus, under this phase 3 study, the hydrogen production potential of the EAS region is estimated. The hydrogen production potential from unused energies will be less than 10% of the hydrogen demand potential estimated under phase 2 of this study, and it is mostly derived from low-ranked coal due to the limitation of existing data, especially on hydropower potential.

This study also seeks an optimal hydrogen supply chain between hydrogen-producing and -consuming countries in the EAS region through two hydrogen transport technologies by ship: methylcyclohexane (MCH) and liquid hydrogen. Generally, liquid hydrogen is appropriate for long-distance transport and large volumes. In addition, hydrogen shipment within ASEAN is important to optimise the hydrogen transport cost in the EAS region.

Under phase 3, two virtual hydrogen workshops were held for India and Malaysia to introduce major outcomes of the phase 2 study, including hydrogen production technologies and their costs, revision of EAS country hydrogen demand by 2040, and presentations on New Energy and Industrial Technology Development Organization (NEDO) hydrogen projects. For India and Malaysia, ERIA worked with the International Advanced Research Centre for Powder Metallurgy and New Materials to hold the workshop as well as the Ministry of Energy and Natural Resources, Government of Malaysia.

A low-carbon energy transition is the first priority, as announced at EAS Energy Ministers Meeting, hosted by Brunei Darussalam in September 2021. Use of hydrogen as a renewable energy was also highlighted to achieve a low-carbon energy transition. Consequently, the first EAS Hydrogen Working Group was created, consisting of Australia, Brunei Darussalam, China, India, Indonesia, Japan, Malaysia, New Zealand, and Thailand. It discussed the role of

hydrogen in contributing to a low-carbon energy transition or carbon-neutral pathway for EAS countries. Australia, Japan, and New Zealand emphasised the importance of hydrogen in their carbon-neutral scenario or road map up to 2050. However, China, Brunei Darussalam, India, Indonesia, Malaysia, and Thailand still consider variable renewable energies, such as solar and wind, as ultimate energy sources to achieve their low-carbon energy transition.

ERIA then held the Second EAS Hydrogen Working Group meeting, which consisted of a brief presentation of the phase 3 study contents, including the review of hydrogen production technologies and their costs as well as an optimal hydrogen transport solution. There were also introductory presentations on hydrogen use for power generation instead of gas power generation and NEDO hydrogen projects. ERIA will continue to investigate wider uses of hydrogen in the EAS region through conferences, workshops, and meetings.