

1 February 2023

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# Toward a regional hydrogen ecosystem for ASEAN

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POLICY BRIEF



## Highlights

1. Enabling ecosystems and incentive structures at both national and regional levels are key to accelerate the region's hydrogen development.
2. The hydrogen industry needs to play an active role in shaping future national and regional policies.
3. Consensus among ASEAN Member States on the most preferred hydrogen carrier is crucial for scaling up regional demand.
4. Focus on plausible "catalytic" technologies and solutions to enable collaborations among ASEAN Member States towards regional "hydrogen diplomacy"

## Summary

Hydrogen represents a strategic energy option to transition the ASEAN region away from fossil fuels. ASEAN Member States need to work together to enhance national-level efforts towards regional "hydrogen diplomacy" to ensure the region is well-positioned to reap the collective benefits from global hydrogen development.

## What's the issue?

Even as the world is struggling to recover from the devastating impact of the global COVID-19 pandemic, the outbreak of war in Ukraine has sent fossil fuel prices skyrocketing yet again, posing a considerable energy security threat to many Asian countries.<sup>1</sup> With China reopening its economy after the pandemic, rising fossil fuel demand will likely push energy prices to new heights in 2023.

In addition, all ASEAN (acronym for Association of South-East Asian Nations) Member States (AMS) are signatories to the Paris Agreement – with Indonesia, Singapore, Thailand, and Vietnam having just

made a second update to their Nationally Determined Contributions (NDCs) in 2022. All AMS have also pledged to achieve carbon neutrality around mid-century to demonstrate their respective national commitments to strengthen climate action.

More importantly, energy security, affordability and resilience remain a top priority for AMS in the energy transition journey towards carbon neutrality. Against this backdrop, several AMS have turned to hydrogen as an alternative clean fuel of strategic importance.

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<sup>1</sup> Maciej Kolaczowski. "How does the war in Ukraine affect oil prices?". World Economic Forum. March 4, 2022. <https://www.weforum.org/agenda/2022/03/how-does-the-war-in-ukraine-affect-oil-prices/>.

## Why is this important?

Between the late 2010s and early 2020s, ASEAN regional “hydrogen diplomacy” efforts have resulted in several key announcements and actions on hydrogen development. The most notable project being the Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD) which saw the first shipment of hydrogen in the form of Methylcyclohexane<sup>2</sup> from Brunei to Japan. Partnerships with Japan have also been seen in Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam (see CSER Knowledge Base on *ASEAN Regional Hydrogen Initiatives* for more details and continuous updates).

The present regional developments in hydrogen suggest an emphasis on an outward-facing “hydrogen diplomacy” between an AMS and non-AMS partners such as Australia and Japan. There are barely any partnerships in hydrogen development among AMS. As of 31 January 2023, the only visible initiative involving multiple AMS is the Joint Study Agreement to explore the development of green hydrogen and ammonia projects in Indonesia signed in November 2022 among Indonesia’s Pertamina Power Indonesia, Singapore’s Keppel Infrastructure, and the United States Chevron Corporation.<sup>3</sup>

Whilst collaborations on hydrogen within ASEAN remain limited, similar to the experience of the European Union and the United States, unleashing the region’s own capacity in hydrogen technology can

leverage local knowledge and expertise of companies and other key actors that understand its unique challenges and opportunities. Collaboration among stakeholders within ASEAN will enhance individual AMS efforts and can help ensure the region is well-positioned to reap the potential collective benefits from hydrogen development.

In addition to the lack of intra-regional collaboration, the ASEAN region is also facing three critical issues in hydrogen development. First, the limited access to renewable energy in the AMS creates a ‘volume issue’, which poses practical challenges to scale green hydrogen production even for meeting foreseeable future regional demand. Next, there are technical challenges at almost all levels of the hydrogen ecosystem, including a general lack of dedicated infrastructure for hydrogen and its carriers (for storage, distribution networks, and refuelling stations), a lack of visible scale of downstream applications, and a lack of regulatory and market frameworks at both national and regional levels. Last and most important, there is uncertainty of which type of hydrogen carrier, especially among liquid hydrogen, ammonia, and MCH, is poised to become the most preferred or dominant one in the region.

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<sup>2</sup> NYK Line. “World’s First Global Hydrogen Supply Chain Demonstration Project Starts in Earnest”. June 26, 2020. [https://www.nyk.com/english/news/2020/20200625\\_01.html](https://www.nyk.com/english/news/2020/20200625_01.html).

<sup>3</sup> Pertamina, “Pertamina NRE, Keppel Infrastructure, and Chevron Sign Agreement to Explore Green Hydrogen and Green Ammonia Development Projects in Indonesia”. November 11, 2022. <https://www.pertamina.com/en/news-room/news-release/pertamina-nre-keppel-infrastructure-and-chevron-sign-agreement-to-explore-green-hydrogen-and-green-ammonia-development-projects-in-indonesia>.



## What should the policymakers do?

### 1. Focus on development and use of regional case scenarios to identify most plausible hydrogen carriers and create and expand a sizable market

Global development in technology will be driven by use of case scenarios for hydrogen as fuel and feedstock for future carbon-neutral energy services and products. However, ASEAN's current renewable agenda is constrained by limited access to renewable energy and the rapidly rising domestic demand for carbon-free energy would likely make ASEAN a net-importer for green hydrogen. It is therefore unlikely that the cost of hydrogen access in the region is to decrease if AMS has to manage shipping, storage and distribution of different types of hydrogen carriers without scale. Achieving regional consensus on the most preferred types of hydrogen carriers will allow the opportunity to scale up common demand and a more advantageous position for ASEAN as a regional bloc in future international hydrogen trade.

### 2. Establish a sound basis for future hydrogen carrier import-export arrangements

AMS should leverage on the experience and insights from existing oil and gas trade networks in the region, especially those with physical connections, to collectively evaluate and agree on common types of hydrogen carriers to enable intra- and inter-regional import-export for added regional hydrogen resilience. In addition, AMS should also consider a harmonisation approach by agreeing on a set of regionally recognised

codes and standards, and regulatory and legislative frameworks governing the hydrogen industry in support of a safe, secure and reliable regional hydrogen ecosystem.

### 3. Focus on ecosystem level technology mapping and solution development instead of only on bottlenecks

The presence of bottlenecks is not necessarily linked to specific technology readiness levels, but other constraining factors prohibiting the industrial-scale deployment of such technologies. Near-term availability and long-term supply resilience and demand flexibility lie with an ecosystem of available and 'can-be-made-available' technologies and infrastructure contextualised in a mutually beneficial trade arrangement. The AHEAD project demonstrated the possibility of bilateral co-development of technology and infrastructure to enable the one-way export of a hydrogen carrier from a resource-rich country to a resource-poor country. The key is to establish multiple sources of green hydrogen supply and demand in several countries in and outside of ASEAN that could form a closed-loop ecosystem to ensure security of hydrogen supply and scale of downstream demand, with flexible interchange of roles in the 'seasonal' supply-demand balance.

### 4. Key stakeholders and actors in the hydrogen ecosystem need to play an active role in driving and shaping future policy development

Building a sustainable hydrogen ecosystem requires the participation of all relevant

hydrogen industrial actors. Industrial actions are poised to assert a strong thrust given the present ‘chicken-and-egg problems’ in the nexus of demand visibility, technology readiness, and scalability of supply. Industry actors, such as technology vendors, project developers, shipping companies, terminal operators, financial institutions, as well as existing energy enterprises are all well placed to enable cross-sectoral coordination in scaling up the demand, value chain level pilots of key enabling technologies (such as shipping, storage, and carrier conversion), and the widening of the portfolio of green hydrogen producing energy sources. The collective actions of industry can translate into lessons learnt to shape future regional and national policy and regulatory development tailored at addressing present and prospective future bottlenecks and helping the industry navigate through uncertainties.

## 5. Consider offshore floating multi-utility complexes as a catalyst of future regional clean energy ecosystems

An offshore floating multi-utility complex (FMUC) as conceptualised by CSER is aimed at optimising the use of carbon-free energy resources in the most economical and flexible way possible while addressing equally important strategic national and regional energy objectives. The core idea of the FMUC is around floating clean energy resources, such as renewables and nuclear to enable the co-production of multiple energy-related products including hydrogen, ammonia, methanol, electricity, heating, and cooling thereby enabling a true net-zero carbon industrial park that does not occupy large areas of land.

A network of FMUCs with complementing functionalities across ASEAN can enable

innovative financing and business models (such as an asset-light investment model, co-investment based on shares of energy product output, and flexible energy purchase contracts) to facilitate co-investment from both the private sector as well as sovereign funds. More importantly, FMUC networks can further enable multi-route commercial trading of energy products without being constrained by bilateral or multilateral import-export arrangements. In that sense, FMUCs could serve as additional “pull factors” for ASEAN’s regional energy market integration, including for hydrogen<sup>4</sup>.

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<sup>4</sup>Victor Nian. “An ecosystem approach to maritime decarbonisation in ASEAN”. Green Denmark in Southeast Asia. July 19, 2022. <https://www.greendkinsea.com/post/an-ecosystem-approach-to-maritime-decarbonisation-in-asean>.



## Biography

**Dr Victor Nian** is a Co-Founder and Chief Executive Officer of the Centre for Strategic Energy and Resources. His expertise is in energy, sustainability, and net-zero policy and strategies. He is one of the go-to-persons in nuclear energy and the hydrogen economy in Southeast Asia. Dr Nian holds a PhD in Mechanical Engineering and BEng (Hons) in Electrical Engineering with a Minor in Management of Technology, all from the National University of Singapore.

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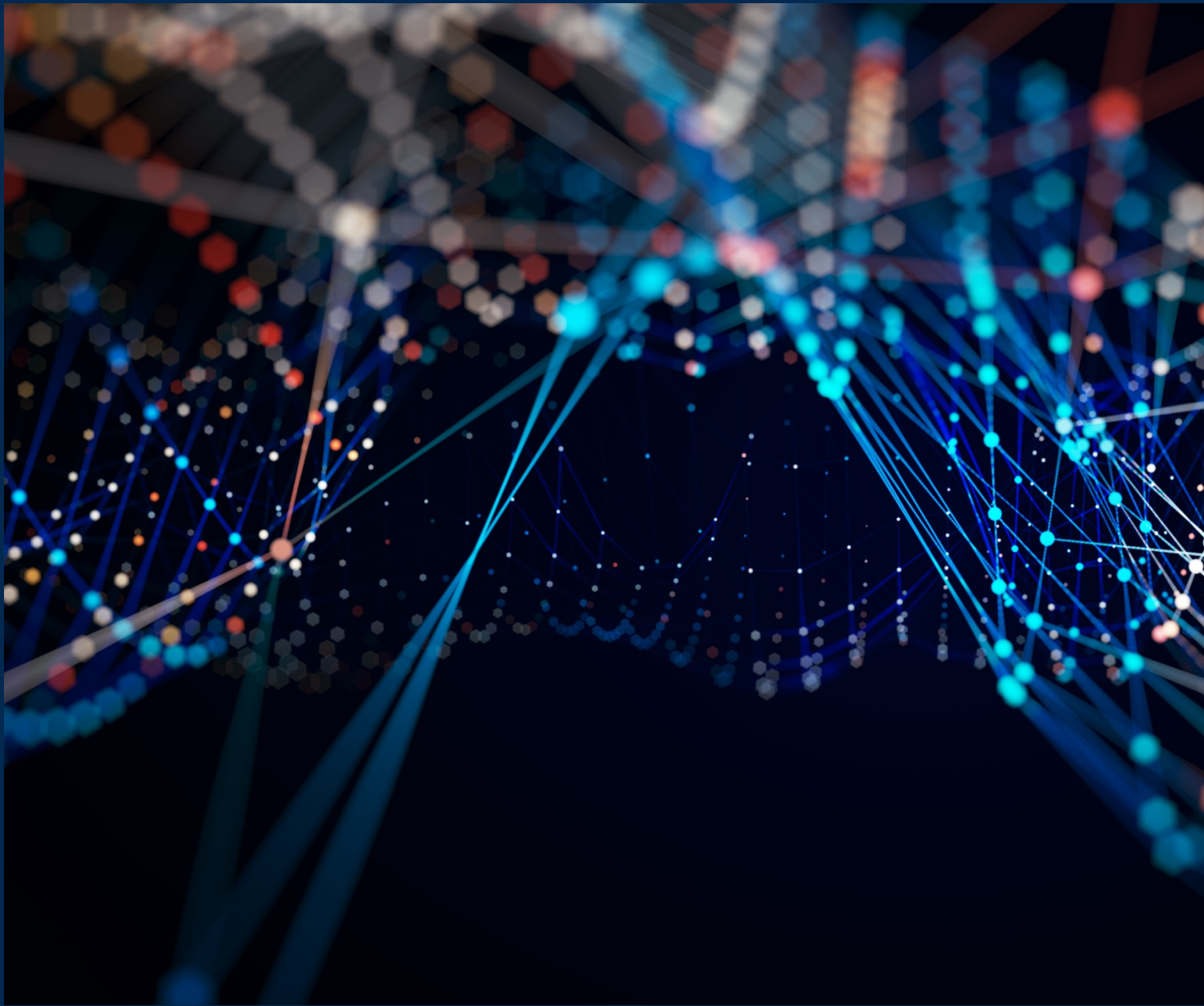
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