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Ammonia as a Maritime Fuel: Challenges, Opportunities, and Policy Priorities for Asia Pacific

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POLICY BRIEF

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Centre for Strategic Energy and Resources

Highlights

1. Ammonia has the potential to become a key fuel for maritime decarbonisation, but its future is far from guaranteed.
2. The transition requires commitment in addressing intertwined challenges of safety, cost, infrastructure and policy coordination.
3. Breaking the current investment deadlock will require strong policy signals, cross-sector collaboration, and institutional and economic coordination
4. Emerging Asia should take on a proactive role for cleaner fuel adoption instead of waiting for collective "international actions" given its strategic position as the global maritime hub
5. A "colour-neutral" low-carbon taxonomy is needed to replace the popularly politicised notion of "green fuel" while building an ammonia ecosystem in the Asia Pacific region

Summary

Ammonia offers a credible pathway to decarbonise global shipping but faces interlinked challenges in safety, cost, infrastructure, and investment coordination. Despite slow multilateral progress, Asia Pacific is well positioned to lead early adoption given its central role in global trade and bunkering. Breaking the current investment deadlock requires strong, clear, and credible policy frameworks that can underpin demand creation, alongside coordinated value chain development and cross-sector demand aggregation. Establishing a 'colour-neutral', life cycle-based fuel framework and strengthening regional collaboration will be critical to scaling low-carbon ammonia while safeguarding energy security and industrial competitiveness.

What's the issue?

The global maritime industry operates at an immense scale, with approximately 109,000 vessels forming a fleet of over 2.4 billion deadweight tons. It underpins around 80–90 per cent of global trade, handling nearly 858 million TEUs of containerised cargo annually. This scale is matched by its energy footprint demanding between 220 and 300 million tonnes of bunker fuel each year, equivalent to roughly 4.2 million barrels of oil per day and remains almost entirely dependent on fossil fuels. As a result, the sector accounts for around 3 per cent of global carbon dioxide emissions.[1] If shipping were a country, it would rank among the world's top ten emitters.

Decarbonising the shipping sector remains one of the most intractable challenges of the global energy transition. The 2023 IMO Strategy on Reduction of GHG Emissions from Ships, which was unanimously adopted on July 2023 at the 80th session of the Marine

[1] United Nations, "A Historic Course Correction: How the World's Shipping Sector Is Setting Sail for Net Zero," October 16, 2025.

Environment Protection Committee (MEPC 80), established a landmark pathway: net-zero GHG emissions from international shipping by or around 2050, with indicative checkpoints of at least 20–30 per cent reduction by 2030 and at 70–80 per cent by 2040 (both compared to 2008 levels), and a target for zero or near-zero emission fuels to represent at least 5 per cent, striving for 10 per cent, of international shipping energy use by 2030.[2]

In April 2025, MEPC 83 approved the IMO Net-Zero Framework (NZF) dubbed the world's first binding carbon pricing and fuel-intensity standard covering an entire sector, with an intend to apply from 2027 to large ocean-going vessels above 5,000 gross tonnes, which account for 85 per cent of total GHG emissions from international shipping. An initial carbon price of USD 100-150 per tonne of GHG is projected to generate USD 10–12 billion annually[3] which could be used for redistribution toward low-carbon fuel development and a just transition. Formal adoption of the mandatory regulations of IMO NZF was delayed by one year at an extraordinary meeting in October 2025, pushing the decision to October 2026[4].

Despite this regulatory momentum, the transition is still in its early stages. As of 2024, 93 per cent of vessels at sea still ran on conventional fossil fuels,[5] even as alternative-fuel ship orders surged 50 per cent in 2024 with ammonia-fuelled vessel orders more than doubling year-on-year.[6] Among the available low-carbon alternatives, ammonia has attracted increasing attention due to its relatively high energy density in liquid form and no presence of carbon content. Targeting top 10 regional ports in Oceania, North Africa, South Asia and Southeast Asia could enable low-carbon ammonia to supply as much as 60 per cent of the fuel demand.[7] Beyond the maritime sector, ammonia can also be used as an alternative low-carbon fuel for land transport, and the heat and power industry.[8]

At the heart of ammonia's adoption challenge lies a structural "chicken-and-egg" dilemma. Producers are reluctant to invest in large-scale low-carbon ammonia production capacity without secured long-term demand from shipping companies. Shipowners, for their part, are unwilling to order ammonia-powered vessels without assurance of fuel availability, competitive cost, and mature safety protocols. This mutual dependency or the "wait and see" attitude has created a persistent investment deadlock across the ammonia value chain.

Ultimately, the viability of ammonia is not determined by technology readiness alone, but by the strength and clarity of policy frameworks that can enable demand creation, investment confidence, and system-wide coordination.

The financial scale of the challenge is significant. Fully decarbonising the shipping industry with ammonia as the primary zero-carbon fuel would require cumulative investment of USD 1.4–1.9 trillion between 2030 and 2050, of which 87 per cent is upstream (production, storage, bunkering) and 13 per cent is vessel-related.[9] Approximately USD 2 trillion would be required by 2050 for a global green ammonia supply chain.7

[2] International Maritime Organisation. 2023. "2023 IMO Strategy on Reduction of GHG Emissions from Ships." MEPC 80/17/Add.1.
[3] Gianino, Sebastiano, and Ludovic Laffineur. 2025. "Equity in Motion: Revenue Disbursement for a Just and Equitable Maritime Transition under the IMO S Net-Zero Framework." Forum on Trade, Environment, & the SDGs (TESS). July 24, 2025.
[4] DNV, "Decision on the IMO Net-Zero Framework delayed for one year," October 17, 2025.
[5] Knut Ørbeck-Nilssen, "Maritime Forecast to 2050," *Energy Transition Outlook* 2024, 2024.
[6] Lloyd's Register, "Alternative-Fuelled Ship Orders Grow 50% in 2024," January 2, 2025.
[7] Jasper Verschuur, Nicholas Salmon, Jim Hall, and René Bañares-Alcántara, "Optimal Fuel Supply of Green Ammonia to Decarbonise Global Shipping," *Environmental Research Infrastructure and Sustainability* 4, no. 1 (2024): 015001.
[8] Silva, Valter Bruno, Sousa Cardoso João, and Antonio Chavando. 2025. Ammonia as an Alternative Fuel and Power-to-X Enabler. Elsevier.
[9] Raucci, Carlo, Jean Marc Bonello, Santiago Suarez De La Fuente, Tristan Smith, and Kasper Søgaard. 2020. "Aggregate Investment for the Decarbonisation of the Shipping Industry." UMAS.

Cost competitiveness remains one of ammonia's most significant barriers. IRENA estimates current green ammonia (i.e. ammonia produced from renewable energy) production costs at approximately USD 720/tonne at best-resource locations, and projected to decline to USD 480/tonne by 2030 and USD 310/tonne by 2050.[10] Blue ammonia (with 95 per cent carbon capture) was offered at USD 320–330/tonne free-on-board US Gulf Coast in early 2025, while green ammonia delivered to Far East Asia averaged approximately USD 888/tonne.[11] DNV forecasts that under carbon pricing scenarios, ammonia bunker costs could converge toward USD 1,000–1,900 per tonne of marine gas oil equivalent by 2050, approaching parity with conventionally fuelled shipping subject to the IMO carbon price.12

Despite the present challenges, there are positive signs and market signals are beginning to improve. In 2024, ammonia-fuelled vessel orders more than doubled year-on-year, and the first commercially viable two-stroke ammonia-burning engines were delivered in 2024–2025.[12] It is likely that the conditions for commercial ammonia marine fuel deployment by 2030 are within reach, contingent on policy alignment.[13] By 2024, alternative-fuel vessels (such as LNG, methanol, and ammonia) accounted for over 50 per cent of global newbuilding orders by deadweight tonnage for the first time.[14]

While ammonia produces no CO_2 when combusted, its life cycle climate impact is more complex. During combustion, ammonia engines can produce nitrous oxides (N_2O) which is 273 times more powerful than CO_2 in causing global warming,[15] and unburned ammonia (NH_3 slip). Minimising N_2O, and NH_3 slip are crucial for ammonia to deliver meaningful climate benefits as uncontrolled N_2O emissions from ammonia-powered ships could carry a climate impact equivalent to 5.8 per cent of current shipping CO_2 emissions.[16] These life cycle uncertainties reinforce the importance of well-to-wake accounting beyond simple tank-to-wake calculations which the IMO NZF has now approved as its regulatory basis.[17]

Safety remains a major concern that distinguishes ammonia from other marine fuels under consideration. Ammonia is very toxic to humans at a concentration level as low as 25 ppm (acronym for parts per million), corrosive to many metallic and alloy materials, and requires careful management across the value chain. Stakeholders at a recent roundtable organised by the Centre for Strategic Energy and Resources in collaboration with T&E Asia Pacific and the Royal Danish Embassy in Singapore emphasised that the safety challenge extends beyond engine technology to crew training, leak detection systems, emergency response, and community acceptance in ports. A single high-profile accident could significantly

[10] International Renewable Energy Agency and Ammonia Energy Association. 2022. "Innovation Outlook: Renewable Ammonia."
[11] S&P Global Commodity Insights, "Blue, Green Ammonia Prices Diverge as Electrolysis Power Prices Rise, Natural Gas Falls," March 19, 2024.
[12] DNV. 2025. "Ammonia as a Marine Fuel: Prospects and Challenges." September 10, 2025.
[13] Gururaja, Prashanth, and Serkan Ünalan. 2025. "Can Ammonia Propel the Shipping Industry toward a Zero-Carbon Future?" ClimateWorks Foundation. March 21, 2025.
[14] Wang, Shasha, Yanan Liu, Jinglin Zhang, Lifang Zhao, and Xiaofei Liu. 2025. "Global Coordination and Challenges of Technical Standards and Application Specifications for Marine Clean Alternative Fuels in the IMO's New Emission Reduction Regulations." Frontiers in Marine Science 12 (December).
[15] Intergovernmental Panel on Climate Change. 2023. "Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." Cambridge University Press.
[16] Wong, Anthony Y H, Noelle E Selin, Sebastian D Eastham, Christine Mounaïm-Rousselle, Yiqi Zhang, and Florian Allroggen. 2024. "Climate and Air Quality Impact of Using Ammonia as an Alternative Shipping Fuel." *Environmental Research Letters* 19 (8): 084002.
[17] UN Trade and Development (UNCTAD). 2023. "Net-Zero by 2050: Achieving Shipping Decarbonization through Industry Momentum and the New Ambition at IMO." September 22, 2023.

undermine confidence in ammonia as a viable fuel.

The development of commercially viable ammonia-burning engine, including the WinGD X52DF-A two-stroke engine delivered in 2025[18] represents a technical milestone, but safe operational integration across entire vessels and bunkering systems remains a work in progress. A significant regulatory step came in December 2024, when IMO's Maritime Safety Committee (MSC 109) approved interim guidelines for the safe use of ammonia as a marine fuel.[19] However, binding standards and comprehensive amendments to the International Code of Safety for Ship Using Gases or Other Low-flashpoint Fuels (IGF Code) must follow before large-scale deployment can proceed. The IGF Code (entered into force on 1 January 2017) is a mandatory IMO standard ensuring safety for ships using low-flashpoint fuel, such as LNG to minimize risks to crew, ships, and the environment.

While ammonia may ultimately be recognised as a key low-carbon fuel, a less examined implication is its potential competition with food production, as increased demand for energy use could place additional pressure on ammonia supply for fertiliser feedstock. Any expansion of ammonia use for maritime energy must be weighed against its essential role in global food production. In 2020, global ammonia production reached approximately 183 million metric tonnes, with around 70 per cent used in agriculture as the feedstock for nitrogen-based fertilisers.[20] As of 2021, ammonia production already accounts for approximately 1.8 per cent of global CO_2 emissions and 2 per cent of global energy demand annually.[21] Scaling ammonia production for energy use must be accompanied by proportional expansion of low-carbon production capacity to avoid impacting food security, particularly in developing nations.

Why is this important?

The Asia Pacific region occupies a uniquely pivotal position in global maritime trade. The Strait of Malacca accommodates more than 60,000 vessels annually, representing approximately 25 per cent of global maritime trade. Singapore handles roughly one-fifth of global container transshipment and, in 2025, recorded bunker sales of 56.7 million metric tonnes.[22] Beyond climate concerns, this heavy reliance on conventional marine fuels exposes the sector to significant energy security risks, including fuel price volatility and geopolitical disruptions to key maritime chokepoints. Together, these factors underscore the urgent need to accelerate the transition towards alternative fuels for shipping. Leadership in ammonia bunkering would strengthen Singapore's and the broader region's position in the global maritime value chain.

For much of Southeast Asia, the ammonia transition also carries energy security dimensions. The IEA's Southeast Asia Energy Outlook 2024 found that, under current policies, the region's annual oil import bill could surpass USD 200 billion by mid-

[18] WinGD, 2025,"WinGD's first ammonia-fuelled engine installed on EXMAR vessels." July 16, 2025
[19] International Maritime Organisation. 2025. "Interim Guidelines for the Safety of Ships Using Ammonia as Fuel." MSC.1/Circ.1687.
[20] Mingolla, Stefano, and Lorenzo Rosa. 2025. "Low-Carbon Ammonia Production Is Essential for Resilient and Sustainable Agriculture." Nature Food 6 (6): 610–21.
[21] IEA, *Ammonia Technology Roadmap: Towards More Sustainable Nitrogen Fertiliser and Hydrogen Production* (Paris: International Energy Agency, 2021).
[22] Maritime and Port Authority of Singapore. 2026. "Singapore Posts Record Port Performance in 2025 and Develops Future Readiness through Industry Collaborations for 2026." Press release. January 13, 2026.

century.[23] Continued fossil fuel dependence materially amplifies macroeconomic vulnerability to supply disruptions.[24] Developing a regional ammonia supply chain could simultaneously address decarbonisation goals and reduce dependence on imported fossil energy.

Ammonia's chemical stability makes it a practical medium for transporting renewable energy over long distances. The region's diverse resource endowments, namely, Indonesia's estimated 2,900 GW of solar PV potential, Laos's hydropower surplus, and Vietnam's offshore wind resources create conditions for a regionally integrated, low-carbon ammonia supply network.[25]

Singapore has made early and meaningful progress in building the conditions for ammonia bunkering. In March 2024, Fortescue with support from MPA Singapore conducted the world's first use of ammonia in combination with diesel as marine fuel onboard the Green Pioneer.[26] MPA has committed to publishing ammonia bunkering standards by 2026.[27] MPA Singapore and Energy Management Authority (EMA) have jointly established Expression of Interest to develop end-to-end solution for ammonia procurement, import, storage, distribution, and end-use for both power generation and bunkering, which as since been evolved into a Request for Proposal.

Itochu ordered the world's first purpose-built ammonia bunkering vessel (5000 m^3) for Singapore, with delivery expected in late 2026, positioning Singapore to host commercial ammonia bunkering in the second half of the decade.[28] Port of Rotterdam currently self-assess at Port Readiness Level 6–7 for ammonia bunkering.12

A critical insight from the roundtable was that ammonia adoption cannot be driven by the maritime sector alone. Green ammonia supplied from as few as ten regional fuel ports could decarbonise up to 60 per cent of global shipping.7 The experience from India shows a regional co-investment mechanism for green ammonia infrastructure as a promising catalyst for Asia Pacific deployment, given the scale of financing required and the diversity of national contexts across the region.[29]

Delayed action on fuel transition carries material financial risks for shipowners. Ships ordered today have typical lifetimes of 20–25 years and will need to comply with the IMO's 2040 and 2050 targets. Under the IMO NZF, ships emitting above their annual GFI (acronym for greenhouse gas fuel intensity) thresholds from 2028 would have faced financial penalties.[30] FuelEU Maritime (in force from January 2025) imposes GHG intensity reduction requirements on ships trading in EU waters starting at 2 per cent in 2025 and scaling to 80 per cent by 2050.[31]

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[23] International Energy Agency. 2024. "Southeast Asia Energy Outlook 2024."
[24] Jakob, Michael, and Indra Overland. 2025. "Energy Trade, Emissions and Import Dependence in Southeast Asia." npj Climate Action 4 (1).
[25] World Economic Forum, "How South-East Asian Countries Can Cooperate to Enhance Energy Interconnectivity," July 2024.
[26] Maritime and Port Authority of Singapore. 2024. "Successful Propulsion and Manoeuvrability Trials by Fortescue's Dual-Fuelled Ammonia-Powered Vessel in the Port of Singapore." Press release. May 6, 2024.
[27] Maritime and Port Authority of Singapore. 2026, "Singapore Posts Record Port Performance in 2025 and Develops Future Readiness through Industry Collaborations for 2026," January 13, 2026,
[28] Labrut, Michele. 2025. "Itochu Orders World's First Ammonia Bunkering Vessel." Seatrade Maritime News, July 16, 2025.
[29] Ogino, Kaoru, and Jongmi Son. 2025. "India's Green Hydrogen Review and Perspective." 1491. *ADBI Working Paper*. Asian Development Bank Institute.
[30] European Commission, "Landmark Agreement Towards Achieving Net-Zero Emissions from Global Shipping by 2050," April 11, 2025.
[31] Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the Use of Renewable and Low-Carbon Fuels in Maritime Transport, and Amending Directive 2009/16/EC. PE/26/2023/INIT. L 234/48 (2023).

What should the policymakers do?

1. Provide Clear and Stable Policy Signals

To Regulatory uncertainty continues to be one of the most significant barriers to unlocking investment across the ammonia value chain. The current "wait-and-see" dynamic described earlier is fundamentally driven by the absence of long-term clarity on carbon pricing, fuel standards, and compliance pathways. While the IMO Net-Zero Framework provides an important global baseline, it remains insufficient on its own to drive early investment decisions, particularly given its delay in adoption and the long asset lifetimes in shipping and infrastructure.

Singapore, ASEAN member states, and other Asia Pacific economies should therefore establish clear and durable domestic frameworks that complement and reinforce IMO signals. This includes defining explicit lifecycle emissions thresholds for marine fuels, formally recognising ammonia as a viable compliance pathway within national clean fuel standards, and publishing forward guidance on carbon pricing trajectories or equivalent economic instruments. Such signals should be aligned across energy, transport, and maritime authorities to avoid conflicting incentives.

In practical terms, implementation requires the introduction of legally anchored policy instruments rather than indicative strategies. These may include carbon levies with pre-defined escalation schedules, fuel standard regulations tied to well-to-wake emissions, and compliance credit systems that reward early adoption of low-carbon fuels. Regulatory sandboxes can be used to test ammonia bunkering and fuel use under controlled conditions, allowing authorities to refine rules before full-scale deployment. Regional coordination through ASEAN platforms can further harmonise standards, reducing fragmentation and enabling cross-border fuel trade.

2. De-Risk Early Investment across the Ammonia Value Chain

The scale and structure of required investment, with the majority concentrated in upstream infrastructure, make early-stage projects particularly vulnerable to commercial risk. The "chicken-and-egg" dilemma persists because neither fuel producers nor shipowners are willing to move first without credible risk-sharing mechanisms. Without targeted intervention, capital will continue to flow towards lower-risk transitional fuels, delaying ammonia deployment. Clear and binding regulatory frameworks shall remain the primary driver of market formation. Instruments such as carbon pricing and fuel standards create the long-term demand signals required for investment decisions.

To complement strong regulatory signals, governments across Asia Pacific must take an active role in de-risking early investments. This involves moving beyond general policy support towards structured financial participation in key infrastructure, including production plants, storage facilities, and bunkering systems. Co-investment platforms can be established to pool public and private capital, reducing exposure for individual investors while accelerating project timelines.

Implementation should combine multiple financial instruments tailored to different risk profiles. Contracts for difference can be used to bridge the cost gap between low-carbon ammonia and conventional fuels, providing revenue certainty for producers. Capital grants or concessional loans can support first-of-a-kind infrastructure, while sovereign-backed guarantees can lower financing costs by mitigating counterparty risk. Multilateral development banks such as the Asian Development Bank and Asian Infrastructure Investment Bank should be engaged to provide blended finance structures that crowd in institutional investors. At the regional level, a coordinated financing mechanism could prioritise strategically located ports and production hubs to maximise network effects.

However, we would like emphasise that financial mechanisms, while essential, should be understood as complementary tools to accelerate deployment rather than substitutes for regulatory certainty.

3. Promote Cross-Sector Demand Aggregation

A key structural constraint identified earlier is the lack of sufficient and predictable demand to justify large-scale ammonia production. Cross-sector demand aggregation is essential to achieve scale, and the maritime sector can play a critical role as an anchor demand that creates the initial, bankable signal for low-carbon fuel deployment.

Other regional hubs should take the lead from Singapore in developing integrated industrial clusters where ammonia demand from shipping, power generation, refining, and other industrial applications is aggregated. This approach enables shared infrastructure, improves utilisation rates, and reduces overall system costs. It also aligns with the region's broader energy transition by linking ammonia deployment with hydrogen strategies and renewable energy development. In this context, sector-specific regulation in shipping can serve as a lead driver of early demand, with cross-sector aggregation enabling scale and cost reduction over time.

Operationally, this can be implemented through integrated project tenders that bundle fuel production, infrastructure development, and multi-sector offtake agreements into a single procurement framework. Governments can play a coordinating role by convening industry consortia, standardising contractual structures, and facilitating long-term offtake agreements that provide revenue certainty. At the ASEAN level, regional planning can identify complementary roles for different countries based on resource endowments, enabling a distributed but interconnected supply chain. This reduces duplication of investment and enhances overall system resilience.

4. Establish Transparent Life Cycle Carbon Accounting

The environmental credibility of ammonia as a marine fuel depends on robust and transparent lifecycle emissions accounting. As highlighted earlier, the absence of carbon in combustion does not eliminate emissions across the value chain, particularly with respect to nitrogen oxides and ammonia slip. Without consistent accounting frameworks, there is a risk of misaligned incentives, carbon leakage, and loss of stakeholder confidence.

Asia Pacific economies should therefore collaborate to develop harmonised certification systems that capture full well-to-wake emissions. These systems must incorporate not only carbon dioxide but also other greenhouse gases and pollutants, using scientifically robust metrics aligned with international standards. Consistency with the IMO framework is essential, but regional frameworks can go further in defining measurement, reporting, and verification requirements.

Implementation should involve the creation of digital tracking platforms that record fuel origin, production pathways, and emissions performance in real time. Certification schemes should be interoperable across jurisdictions to facilitate cross-border trade. Governments can mandate disclosure requirements for fuel suppliers and shipping operators, while independent verification bodies ensure data integrity. Over time, integrating these systems with carbon markets or compliance mechanisms will further strengthen incentives for emissions reduction.

5. Prioritise Safety Standards and Operational Readiness

Safety considerations are central to ammonia adoption and represent a potential single point of failure for the entire transition. The toxicity and corrosiveness of ammonia require a level of operational discipline that extends beyond existing fuel systems. As noted earlier, even a single high-profile incident could significantly undermine confidence and delay deployment.

Singapore, given its role as a leading maritime hub, is well positioned to anchor regional safety standards. This requires accelerating the development of binding regulations for ammonia bunkering, storage, and onboard use, building on IMO guidelines but adapting them to local operational contexts. Safety must be embedded across the entire value chain, from production and transport to port handling and vessel operations.

Implementation should focus on both regulatory and capability-building measures. Dedicated training centres and certification programmes for seafarers and port personnel must be scaled up to ensure workforce readiness. Simulation-based training and emergency response drills should be standardised across ports. Investment in detection systems, monitoring technologies, and fail-safe engineering designs will further reduce operational risks. Equally important is proactive public engagement, where transparent communication of risks and mitigation measures helps build trust with port communities and stakeholders.

6. Adopt a Colour-Neutral, Lifecycle-Based Fuel Classification

The current discourse around “green”, “blue”, and other colour-based fuel classifications have introduced unnecessary complexity and political sensitivity into the energy transition. As highlighted in earlier sections, what ultimately matters is life cycle carbon emissions performance. A fragmented classification system risks delaying investment and limiting the range of viable solutions. At the same time, policy frameworks should provide forward-looking direction toward scalable zero-emission fuel pathways, particularly those based on renewable fuels of non-biological origin, to avoid long-term lock-in risks.

Singapore, ASEAN, and key Asia Pacific economies should transition towards a colour-neutral framework based on measurable lifecycle carbon intensity. This approach allows different production pathways to compete on a level playing field while ensuring that environmental objectives are met. It also reduces the risk of geopolitical fragmentation in fuel standards, which could hinder trade and investment.

Implementation requires defining clear emissions thresholds and integrating them into regulatory and market mechanisms. Certification systems should align with these thresholds, enabling transparent comparison across fuels. Governments can incorporate life cycle-based criteria into procurement policies, fuel standards, and incentive schemes, ensuring consistency across sectors. Regional alignment through ASEAN and engagement with major trading partners will be critical to ensure interoperability and avoid the emergence of competing standards. Coupled with strategic policy direction, this approach to ensure both technological neutrality in the short term and scalability in the long term.

Centre for Strategic Energy and Resources

Biography

Dr Victor Nian is Founding Co-chairman of the Centre for Strategic Energy and Resources. His expertise spans energy and climate policy, sustainability and net-zero strategy, long-term planning, and industrial economy. He is a recognised authority in nuclear energy, digital transformation, and sustainability governance in Southeast Asia. He advises public and private organisations on geopolitics and market dynamics of strategic and/or sensitive technologies to support decision-making. He leads efforts in technology commercialisation, value chain development, and fostering private-public collaboration to accelerate the energy transition and digital economy in emerging Asian markets. He holds a PhD in Mechanical Engineering and a BEng (Hons) in Electrical Engineering with a Minor in Management of Technology from the National University of Singapore.

Joselito Guevarra is the Maritime Transport Policy Manager at T&E (Transport & Environment) Asia Pacific. He brings with him more than 20 years of collective experience across several key industries and the international development sector, with leadership stints in IPIECA, C40 Cities, Asian Development Bank (ADB) and Mott MacDonald in the areas of climate policy, decarbonisation, environmental and social performance, transition planning, sustainability and crisis management. He is leading the T&E engagement and advocacy activities in the shipping industry towards decarbonisation in Singapore and in the wider APAC region. He holds a Master of Science (MSc) degree in Environmental Management from the National University of Singapore.

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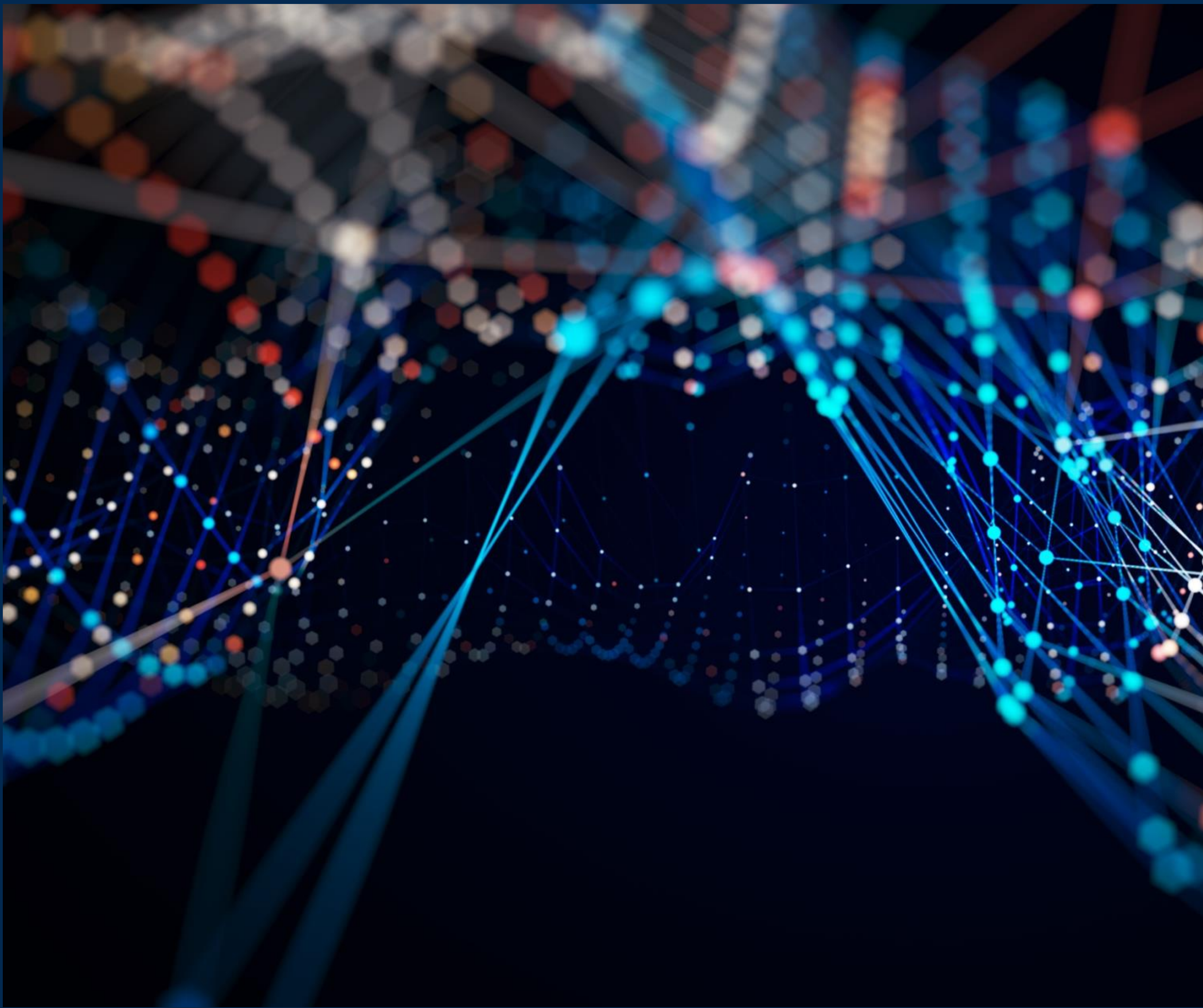

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