GETTING TO ZERO COALITION
GLOBAL MARITIME FORUM

AGGREGATING DEMAND FOR ZERO-EMISSION SHIPPING FUELS

PART 1: CONCEPTS AND APPROACHES

This insight brief is the first in a two-part series exploring the topic of demand aggregation for zero-emission shipping fuels and the role it can play in supporting their early uptake in the sector. It provides an overview of the challenges early movers are experiencing in securing green methanol and ammonia, and how demand aggregation could help overcome them.

The second brief surveys the available approaches to aggregating demand for zero-emission fuels in detail and explores how they can be applied by early movers. It can be found here.

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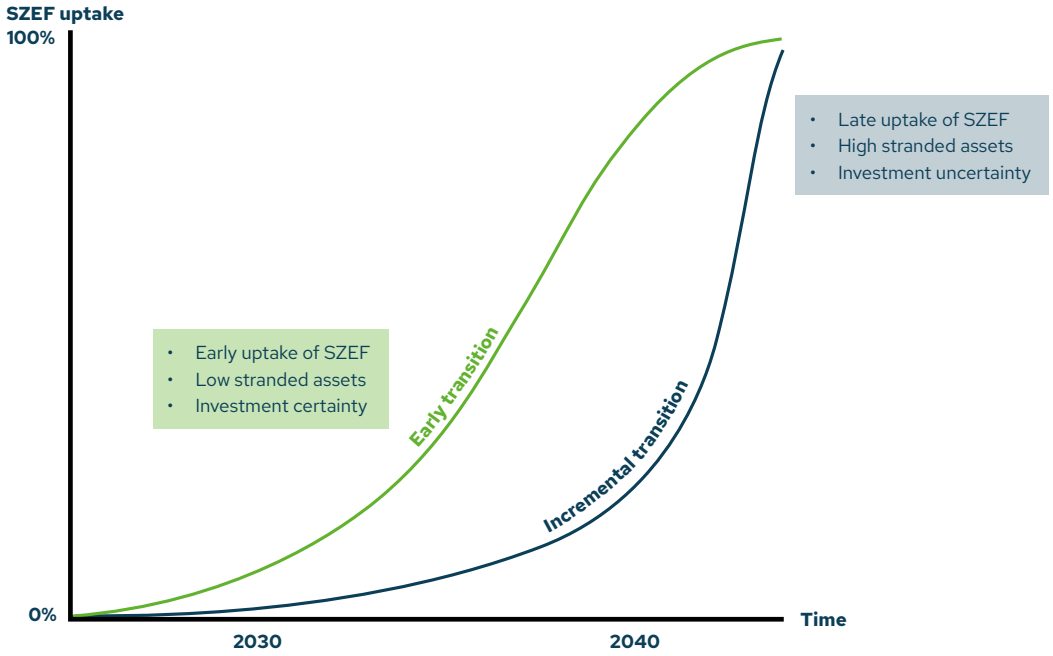
Background and introduction

Following alignment on the need for Paris Agreement-compliant decarbonisation within the industry,[1] the International Maritime Organization's 2023 Greenhouse Gas Strategy set a target for shipping to reach net zero emissions by or around 2050. Several technologies are being considered, but the most cost-effective, just and equitable pathway to reach the IMO's goals is expected to involve early uptake of zero-emission technologies, with a growing portion of international shipping incentivised to move to zero-emission fuels[2] from the late 2020s onwards.[3] This expectation is reflected in the Strategy's target for at least 5%, striving for 10%, zero-emission fuel uptake by 2030.

Figure 1: Two main scenarios for how shipping could reach net zero by 2050



Source: Adapted from Getting to Zero Coalition, 'Unravelling IMO policy measures towards a just and equitable energy transition'

1 Cf. Getting to Zero Coalition 'Call to Action for Shipping Decarbonization', signed by more than 230 industry leaders and organisations in 2021

2 Defined as fuels with the potential to achieve zero- or near-zero greenhouse gas emissions on a lifecycle basis. See the Getting to Zero Coalition's definition of zero carbon energy sources for further clarification

3 For further discussion about the risks and opportunities associated with an early versus incremental transition cf. Getting to Zero Coalition, 'Unravelling IMO policy measures towards a just and equitable energy transition'

Green ammonia and methanol are two zero-emission fuels that have seen significant interest in the industry.[4] Over the past two years, there has been progress in ordering vessels capable of running on methanol or ammonia, with nearly 300 scheduled to be delivered by 2028, and more expected to follow.[5] It has also become clear that substantial amounts of green methanol and ammonia could be available this decade.[6]

Yet only a handful of shipping companies have so far secured supply of the fuels.[7]

A key barrier is the substantial cost premium associated with zero-emission fuels. Much attention has been dedicated to this subject, with industry action and research highlighting the importance of an effective basket of regulatory measures at the IMO, national subsidies for zero-emission fuel, and action by cargo owners to close the gap.[8] But there is increasing understanding that other factors may also be contributing to the low levels of uptake of these fuels. In this context, demand aggregation for zero-emission fuels was a subject of discussion at the Global Maritime Forum Annual Summit 2023 and again at Singapore Maritime Week 2024, most notably at a roundtable co-hosted by the Getting to Zero Coalition and the US Department of Energy, which brought together 30 representatives from leading governments, members of the Getting to Zero Coalition, and global organisations to share perspectives on the topic.

This insight brief provides an overview of the challenges early movers are experiencing in securing green methanol and ammonia and the role demand aggregation could play in overcoming them. Insights are based on interviews with fuel producers, shipowners, and charterers in the Getting to Zero Coalition, as well as the outcomes of the roundtable discussion at Singapore Maritime Week.

Why aggregate demand for zero-emission fuel?

Kickstarting green methanol and ammonia projects

The markets for green methanol and ammonia are at a nascent stage. While the technologies required to produce green forms of methanol and ammonia are well-known, they have not been widely deployed. In response to the need for climate solutions, several hundred green methanol and ammonia production projects have, however, been announced in recent years.

4 Green methanol and green ammonia refer to methanol and ammonia with very low to zero production emissions, including e-methanol and e-ammonia (produced using hydrogen from renewables-based water electrolysis and sustainable carbon or nitrogen) and bio-methanol (produced using waste or residual biomass feedstocks). The phrase "green methanol and ammonia" is used throughout this series as a shorthand to refer to green methanol and green ammonia

5 Of which 269 are methanol-capable vessels and 25 ammonia-capable vessels. Data from DNV Alternative Fuels Insight platform (accessed 02 July 2024)

6 Estimates suggest up to 30-80 million tonnes of e-ammonia and up to 3.5-15 million tonnes of e-methanol. Cf. Zero-Emission Shipping Mission, 'Oceans of Opportunity: Suppling Green Methanol and Ammonia at Ports', GENA Solutions OY, 'Clean ammonia update (June 24)' and 'Renewable methanol update (May 2024)'

7 Most notably Maersk, X-Press Feeders and COSCO, who have signed agreements for bio and/or e-methanol supply, and Hoegh Autoliners, who have formed a partnership for e-ammonia supply.

8 Cf. Getting to Zero-Coalition, 'Closing the Gap: An Overview of the Policy Options to Close the Competitiveness Gap and Enable an Equitable Zero-Emission Fuel Transition in Shipping' and 'National and regional policy for green shipping corridors'

Due to their nascency, the fuels cannot currently be bought on a spot basis, like conventional marine fuels. To source green methanol or ammonia, shipping companies must instead sign advanced purchase agreements with fuel producers - so-called "offtake agreements". As large scale - in many cases, multi-billion dollar – investments and with no merchant market for the fuels, these agreements are essential for proposed projects to obtain the financing they need to progress to implementation.

These offtake agreements are currently negotiated on a case-by-case basis, but insights from leading developers suggest there will be several common features and requirements. These requirements will define the terms on which shipping (and other sectors) are able to access green methanol and/or ammonia in the near term.

Figure 2: Ideal parameters for green methanol and ammonia offtake agreements

Requirement	Description
1 Long-term duration	• Offtake commitments need to be long enough to amortise the upfront investment in the fuel plant. A 10 to 15-year period is emerging as standard but can be adjusted based on price, with slightly shorter periods possible at a higher price or, conversely, slightly longer periods at a lower price.
2 Fixed price	• While benchmark-based pricing is considered, fixed price contracts are preferred to provide a steady, predictable revenue stream.
3 Large volumes	• A significant majority (e.g., 65%+) of the plant's planned capacity must be covered by upfront commitments.
4 Mix of reputable counterparties	• Offtakers need to be creditworthy in the eyes of project investors to provide reassurance they will fulfil their obligations and ensure the project will deliver a return. Up until now, this has generally meant offtakers having an investment grade credit rating. • Developers may seek to further minimise risk by having a portfolio of up to three separate offtake contracts for large projects, featuring not only different counterparties, but ideally different sectors. Within this, there is a preference for a sector such as shipping to constitute no more than two of the three offtakes. For expediency and due to the lower investment level, one offtake is generally preferred for smaller projects.

Source: Expert interviews

To exploit economies of scale, proposed green methanol and ammonia production facilities are also large in size. Of the e-methanol projects seeking to hit operation by 2030, most have a production capacity between pilot scale and 200,000 tonnes per year, while the largest share of

potential supply is from projects with a capacity of between 200,000 and 400,000 tonnes per year. E-ammonia projects seeking to hit operation by the same date range from pilot scale up to multi-million tonnes per year in size, with the largest share of potential supply from projects at the one million tonnes per year scale.[9, 10]

Considering the offtake requirements outlined above, a 300,000 tonnes per year methanol plant may need to achieve around 195,000 tonnes of coverage through one to two offtake agreements, while a one million tonnes per year ammonia plant may need to hit around 650,000 thousand tonnes of coverage through three offtake agreements, to reach final investment decision (FID).

This provides a picture of the commitment associated with offtaking zero-emission fuels; to access supply, shipping companies will need to sign 10-to-15-year contracts for large volumes of green methanol or ammonia, likely in the upper tens of thousands to lower hundreds of thousands of tonnes.

Early mover offtake challenge

Signing commitments of this sort is currently highly challenging for shipping companies, including early movers actively seeking to secure supply. Insights from these early movers and leading green methanol and ammonia project developers suggest that, within the broader context of technology and regulatory uncertainty in the sector, they are facing three main obstacles: financial commitment and capacity, early mover disadvantages, and infrastructure uncertainties and costs.[11]

Financial commitment and capacity

A fuel offtake of this scale would represent a significant balance sheet commitment. At their anticipated cost points, a 100,000-tonne methanol offtake may cost around $100 million per year, while a 215,000-tonne ammonia offtake may cost $170m per year.[12] This could equate to a $1 to $1.7 billion-dollar commitment over the course of a 10-year offtake. As a fragmented industry with highly cyclical market conditions, such a commitment would be difficult for most shipowners to financially accommodate, and a substantial commitment for a charterer, for whom zero-emission shipping may well be a relatively low priority from the perspective of their wider decarbonisation strategy.

For similar reasons, few ship operators are likely to meet stringent creditworthiness requirements. Of the relatively limited proportion of shipowners listed on public markets, very few possess an investment grade credit rating.[13] In bulk trades, shipowners will depend on charterers to procure the fuel. While major mining and agricultural charterers do have investment grade credit ratings, they represent a relatively small group of actors.

9 Global Maritime Forum analysis based on project data from DNV and GENA Solutions OY

10 The difference in the size of projects for the two fuels is likely caused by constraints on the availability of biogenic carbon, used in production of e-methanol. Cf. Maersk Mc-Kinney Moller Center for Zero Carbon Shipping, 'Global Availability of Biogenic Carbon Dioxide and Implications for Maritime Decarbonization'

11 Further, complementary insights from the First Movers' Coalition are included World Economic Forum and Boston Consulting Group, 'Fuelling the Future of Shipping: Key Barriers to Scaling Zero-Emission Fuel Supply'

12 Assuming fixed price offtake agreement at a green methanol cost of $1000 per tonne and green ammonia cost of $800 per tonne, respectively

13 Maersk remains the only investment-grade credit in the container shipping space - Splash247

Early mover disadvantage

There is also a tension between the long-term and potentially fixed price nature of offtake commitments and the expected cost development of green methanol and ammonia.

While green methanol and ammonia are currently multiple times the cost of other fuels, there is a widespread expectation among shipping companies that their cost will fall rapidly as production scales up, and technologies and processes are optimised. This creates a concern among early movers that signing a long-term fixed price offtake will lock them into high prices, putting them at a future disadvantage against later-moving competitors that would benefit from cost reductions.

Infrastructure uncertainties and costs

Finally, in parallel to obtaining volumes of green methanol and ammonia, infrastructure and standards for bunkering the fuels must be established at key ports. Though many ports have some infrastructure for handling the fuels from the chemical trade, new investments will be required. Meanwhile bunkering protocols and guidelines, particularly for safe bunkering of ammonia, remain in development. This creates uncertainties about the availability, safety and cost of bunkering the fuels.

The result is a mismatch between what green methanol and ammonia producers need to kickstart production and the commitments shipping companies are willing and, in some cases, able to make. Where shipping companies do have demand for green methanol or ammonia, it may be small scale, reflecting these risks and challenges.

The role of fuel demand aggregation

Aggregating fuel demand can accelerate and broaden access to fuel by tackling this mismatch.

Demand aggregation refers to platforms, mechanisms, and business arrangements that enable consolidated purchases across multiple actors and/or sectors. It is applied in new or established markets where demand is fragmented. The underlying idea is to enable actors who would not otherwise be able to buy a product or service to do so by combining their demand into a larger and more attractive package.

In the context of green methanol and ammonia as marine fuels, fuel demand aggregation would involve bundling offtake commitments from several companies into a single larger package that meets fuel producers' requirements.[14]

This has the potential to respond to many of the challenges blocking commitment by early movers, including:

- **Flexibility:** Enabling access to green methanol or ammonia supply at a scale aligned with shipping companies' risk appetite and capacity.

14 In the context of zero-emission shipping, demand may either refer to demand for volumes of zero-emission fuel or demand for zero-emission shipping services. The former is the object of fuel demand aggregation efforts - and this insight brief -, while the latter is the object of zero-emission shipping buyers alliance efforts, such as the Zero-Emission Maritime Buyers Alliance. Since they focus on different parts of the shipping value chain, these two types of demand aggregation are distinct. However, they are likely to represent complementary approaches to accelerating uptake of zero-emission fuels in the sector. Further discussion about the interplay between fuel demand aggregation and zero-emission shipping buyers alliances can be found in insight brief two.

- **Cost:** Facilitating access to lower-cost fuel by offtaking larger, more attractive projects and/or achieving better offtake terms through increased bargaining power.
- **Infrastructure investment:** Accelerating the development of new bunkering infrastructure and minimising last mile costs, by increasing levels of throughput at bunker port(s).
- **Financial feasibility:** Making commitments more financially feasible, including potentially taking offtake commitments off shipping companies' balance sheets and/or boosting their creditworthiness in the eyes of fuel projects' financiers.

While efforts could focus on aggregating demand for the fuels within the shipping industry, green methanol and ammonia are expected to play a role in decarbonising multiple industries, including chemicals, fertilisers, and potentially plastics and power. In this context, demand could be aggregated across sectors, with particular opportunities where these industries are located near ports and/or part of cargo owners' stakeholder networks.

Demand aggregation has the potential to play an important role in supporting individual early movers seeking to secure the fuels. But it is likely to be especially relevant for green shipping corridor initiatives.[15] With these collaborations aiming to kickstart the deployment of zero-emission solutions at scale this decade, finding ways to harness participants' joint demand is likely to be important in realising the full potential of green corridors.

How can demand for zero-emission fuel be aggregated?

Overview of potential approaches

There are multiple ways to approach aggregating demand for green methanol and ammonia fuel, with opportunities for different actors in the operational value chain and beyond to take the lead. These can be divided into a) supply-led measures, undertaken by fuel producers; b) demand-led measures, headed by shipowners, charterers, and cargo owners; and c) third party-led measures, spearheaded by ports, traders, or governments.

15 Green corridors refer to specific trade routes where the feasibility of zero-emission shipping is catalysed by public and private actions. See Getting to Zero Coalition, 'The Next Wave: Green Corridors' for further information about green corridors

Figure 3: Overview of fuel demand aggregation measures in shipping

Leadership	Measure	Description
Supply-led (Project developers)	Offtake portfolio	Project developer engages and coordinates possible offtakers
	Time stacking	Project developer splits conventional 10-to-15-year offtake into shorter tranches that can be signed by different offtakers
Demand-led (Shipowners, operators, charterers, cargo owners)	Demand signal initiative	Group of actors communicates an intention to use zero-emission fuel or ships
	Joint procurement	Group of shipowners, operators, or charterers issue a joint tender for an aggregated volume of fuel
	Green joint venture	Entity established to own and operate zero-emission vessels, including procuring fuel
	Zero-emission fuel procurement vehicle	Group of shipowners, operators, or charterers jointly procure zero-emission shipping services through a discrete vehicle
	Zero-emission shipping buyers' alliance	Group of cargo owners jointly procure zero-emission shipping services
Third party-led (Governments, ports, traders)	Hydrogen hub	Network of hydrogen producers, consumers, and connective infrastructure in a specific location
	Match-making	Third party connects potential buyers and sellers of zero-emission fuel
	Zero-emission fuel trading	Third party buys zero-emission fuel and sells on to end-users for a profit
	Market-making	Third party buys zero-emission fuel and sells on to end-users while covering potential losses

Source: Based on desktop research and expert interviews

A distinction can also be drawn between commercial and pre-commercial fuel demand aggregation measures. While most measures focus on the procurement of fuel, several seek to lay the groundwork for future offtakes through the sharing of information about the supply of the fuels, signalling demand and/or creating stakeholder networks. Such pre-commercial measures are likely to complement commercial demand aggregation measures.

Each of these measures is likely to come with pros and cons in terms of practicality and effectiveness. As such, what is most suitable will, to some extent, be context-specific, with geography, the shipping segment, the involved stakeholders, and prevailing regulatory framework all influencing the best approach for specific actors.

Identifying near-term opportunities for action

At the same time, it is important to note that green methanol and ammonia plants can take between two and five years to move from FID to operation.[16] This means that if 5% of vessels are to run on zero-emission fuels by 2030, per the IMO's goals, progress is needed in the coming few years. This makes it relevant to assess which measures provide opportunities for near-term impact.

Supply-led

Within supply-led measures, efforts by project developers to build a portfolio of offtakes that will enable them to reach FID are ongoing today. As reflected by the limited number of offtakes signed to-date, however, this has so far generated limited progress. Solutions to help aggregate infrastructure demand, while rapidly aligning the preferences, volumes, and potentially willingness to pay among groups of diverse offtakers would be needed for these efforts to play a leading role.

The potential for supplier-led action to significantly accelerate progress is instead likely to depend on "time stacking". The idea is for the fuel producer to split the conventional 10-to-15-year offtake into shorter tranches that can be signed by different offtakers, before aligning or "stacking" the tranches to cover the 10-to-15-year offtake period. This is a novel approach that has not yet been put into practice. As such, there remain unknowns about its near-term feasibility, most crucially whether it will be acceptable to fuel project financiers, given that the conventional offtake requirements largely stem from their preferences.

Demand-led

Demand-led measures include joint fuel procurements, joint ventures, and buyers alliances. They represent perhaps the most obvious way shipping could engage in fuel demand aggregation, with interested shipping companies coming together to aggregate their demand for the fuels.

A key near-term challenge for demand-led action is likely to be the collaboration itself. Given the commercially sensitive nature of fuel contracts and potential implications of action on freight costs, care will need to be taken to ensure the full compliance of demand-led aggregation efforts with competition law. Solutions are likely to be available, but evidence from pools, alliances, and other forms of commercial collaboration employed within the sector today suggests that it may

16 *P.7 World Economic Forum and Boston Consulting Group, 'Fuelling the Future of Shipping: Key Barriers to Scaling Zero-Emission Fuel Supply'*

take some time to operationalise demand-led measures in a way that is legally acceptable, in the range of several months to years. Green corridors may be well-placed to serve as test cases, leveraging their collaboration structures and alignment on specific fuels and routes to identify the most effective approaches, which can then be rolled out to the wider sector.

Third party-led

Third-party measures involve a port, government, international institution or trader either connecting buyers and sellers or buying and re-selling fuel in smaller tranches themselves.

Third-party measures may present the best near-term means of supporting demand aggregation for green methanol and ammonia in shipping, for two reasons.

First, the involvement of third parties can be expected to provide multiple benefits while sidestepping competition issues. These include aggregating large volumes across shipping and land-based industries, taking offtake commitments off shipping companies' balance sheets, facilitating and streamlining the logistics around the fuels' delivery, and even closing the cost gap.

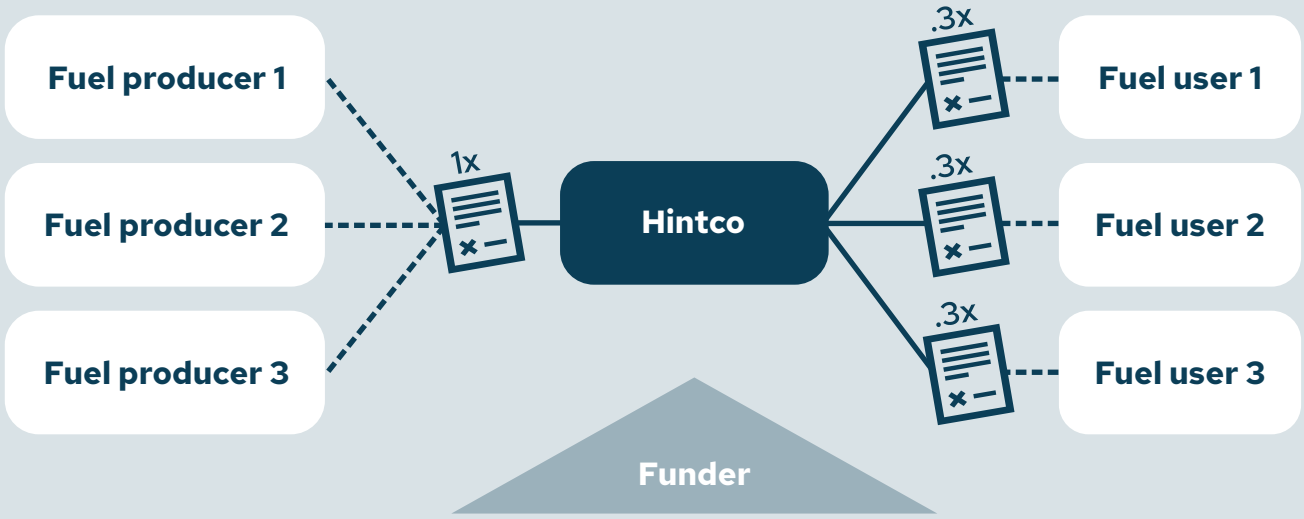
Second, third-party schemes already exist that could be leveraged or replicated to serve shipping's needs. Two of the clearest examples in this regard are the H2Global instrument being employed by the German government and the expressions of interest (EOI) for methanol and ammonia supply launched by the Maritime and Port Authority of Singapore.

H2Global instrument

H2Global was established by the German government in 2021 as an instrument to kickstart the market for clean hydrogen.

Under the scheme, the Hydrogen Intermediary Company (Hintco) – an entity established by H2Global – buys hydrogen derivatives on long-term contracts and sells them on to users on short-term contracts. Both sets of contracts are awarded through a competitive bidding process, with the supplier with the lowest bid being awarded the purchase contract and users with the highest bids being awarded sales contracts. Any gap between the purchase and sales prices is then compensated, reducing the cost premium for the winning users.

Figure 4: Simplified overview of H2Global instrument



Source: Based on H2Global Stiftung, 'The H2Global Instrument'

The first tender from H2Global was launched in December 2022, focused on procuring green ammonia for import into Europe.[17] While initiated by the German government, H2Global is envisaged as a platform that can be used by different governments, pairs of governments, and organisations.

MPA expressions of interest for methanol and ammonia supply

Since 2022, the Maritime and Port Authority of Singapore has launched two EOIs, inviting proposals to build, own and operate an end-to-end low or zero-carbon ammonia power generation and bunkering solution in Jurong Island in 2027,[18] on the one hand, and on the feasibility of developing an end-to-end solution for methanol procurement, storage, sale and delivery as a marine fuel in Singapore at commercial scale from 2025, on the other.[19] The EOIs were informed by consultations to gauge the potential aggregated demand for the fuels in Singapore.

These efforts provide a two-way signal about the potential aggregated demand for the fuels at the port and the feasibility, cost and interest of suppliers meeting it. As such, they represent an example of pre-commercial fuel demand aggregation.

17 The result of the pilot auction was announced in June 2024, with Fertiglobe winning the contract to supply at least 40,000 tonnes of green ammonia per year to Northwestern Europe from 2027/8.

18 Call for Expression of Interest to Develop Low or Zero-carbon Power Generation and Bunkering Solutions (ema.gov.sg)

19 Expression of Interest for the Supply of Methanol as a Marine Bunker Fuel in the Port of Singapore | Maritime and Port Authority of Singapore (mpa.gov.sg)

Conclusions and takeaways

Demand aggregation measures have the potential to accelerate and broaden access to zero-emission fuels by addressing some of the factors keeping first movers from securing supply.

The key takeaways of this insight brief can be summarised as follows:

- **Closing the zero-emission fuel cost gap may not be enough by itself**. While the cost gap is perhaps the biggest issue blocking the scale-up of zero-emission shipping, it is not the only one. A mismatch between what zero-emission fuel producers need to kickstart production projects and what shipping companies are willing and able to commit to is blocking early movers from securing supply of zero-emission fuel.
- **Fuel demand aggregation can help tackle this mismatch**. By pooling the volumes of fuel that different companies can commit to, fuel demand aggregation can give the fuel producers the scale they need while keeping commitments manageable for shipping companies.
- **Third party-led measures may be the most timely, feasible and effective – for now**. While there are opportunities for multiple stakeholders to support fuel demand aggregation, ports, governments, and other actors outside of the operational value chain may play the most important near-term role in unlocking zero-emission fuel supply this decade. Actions could include pre-commercial measures, such as EOIs and hydrogen hubs, and/or commercial measures, such as matchmaking and market making efforts.
- **Green corridors** are likely to both particularly **need demand aggregation** to enable their successful implementation **and serve as good testbeds** for different possible approaches, particularly demand-led measures.

A second insight brief examines the different demand aggregation measures outlined here in detail, including their pros and cons, key enablers, and circumstances in which they can have an impact, as well as exploring how they can be applied in practice. It can be found *here*.