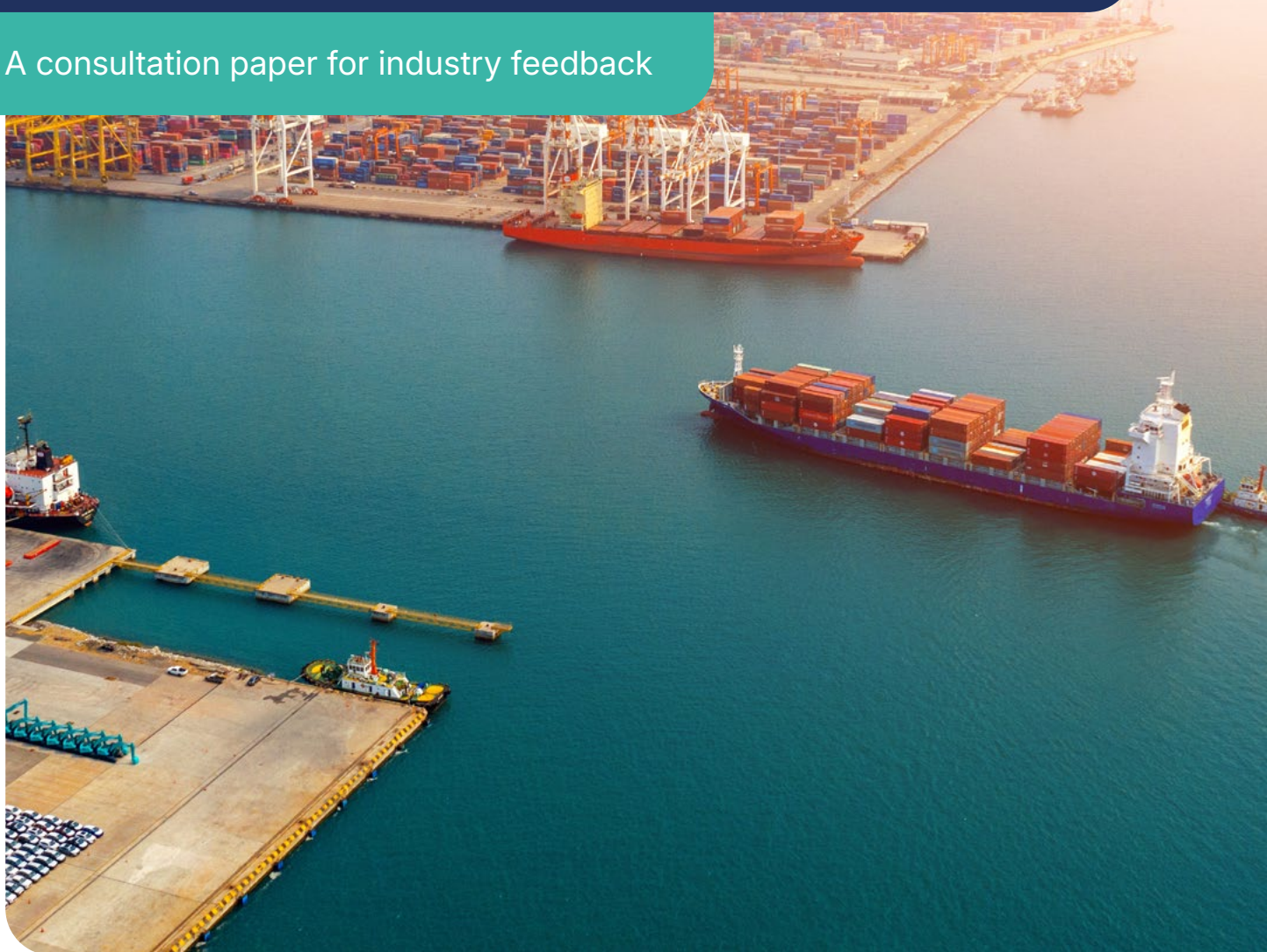
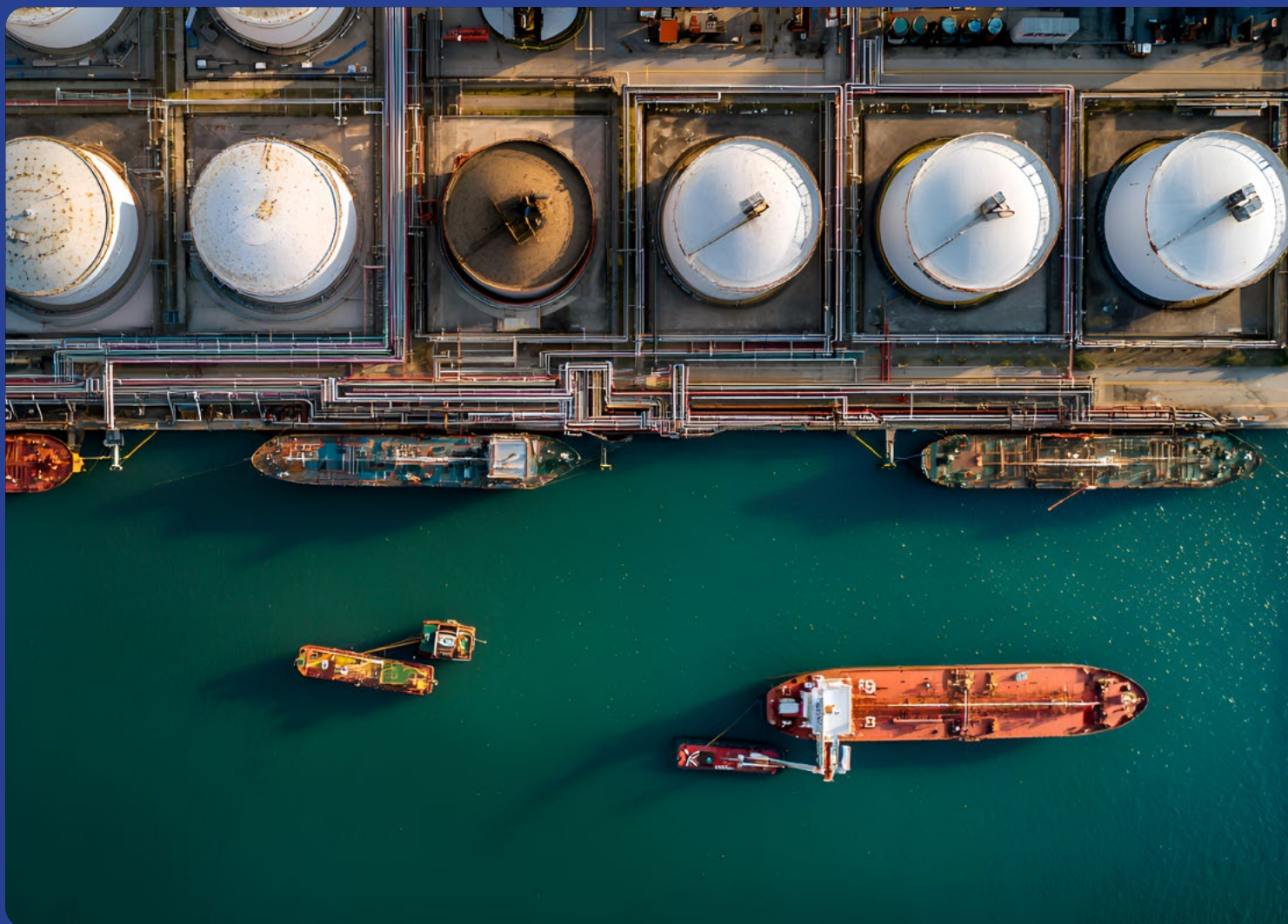


Combining market solutions

H2Global and voluntary book-and-claim mechanisms

A consultation paper for industry feedback





Publication date

August 2026

Lead authors

H2Global Beatrice Malnati, Jean-Marc Bonello, Maximilian Held, Timo Bollerhey

Zero Emission Maritime Buyers Alliance (ZEMBA) Annabella Ronca, Alexander Hueser, Ingrid Irigoyen

Center for Green Market Activation (GMA) Edmond Yi and Megan Wang

Contributing author

Lloyd's Register Maritime Decarbonisation Hub Charlie McKinlay

Disclaimer

This "concept note" is not indicative of any formal partnership nor commitment by or among the authors. Instead, it is meant to transparently explore opportunities and prepare for a broader market consultation on tender concept development.

The collaborative models presented in this paper are conceptual approaches intended to facilitate discussion and stakeholder feedback. None of the models described are currently implemented, and further consultation is needed to assess their feasibility, potential benefits, and key challenges. Stakeholders are encouraged to provide feedback through the accompanying consultation materials.

The proposed auction models may need to be adapted to applicable laws on state aid, public procurement, budgetary, and administrative matters. A legal assessment was outside the scope of this "concept note". Consequently, legal evaluations would have to be conducted in subsequent stages as these auction models are further concretised.

Contents

1. Introduction and purpose	1
2. Context	2
2.1. Zero Emission Maritime Buyers Alliance (ZEMBA)	
2.2. H2Global	
2.3. Synergies between voluntary demand and public support mechanisms	
3. Potential models for public-private collaboration	5
3.1. Opportunity to harmonise support mechanisms	
3.2. Overview of collaborative models	
4. Quantification of benefits	11
5. Request for stakeholder feedback	12
6. Conclusion	13
Appendices	14
Appendix A. Appropriate co-claiming of emissions benefits	
Appendix B. Collaborative model construct	
Appendix C. Stakeholder roles in collaborative models	
Appendix D. Shipping-specific versus multi-sector demand-side auction	

1. Introduction and purpose

The purpose of this concept note is to support discussion on how public-private collaboration can accelerate market development for maritime fuels derived from clean hydrogen (e-fuels).

E-fuels offer a scalable pathway to deep decarbonisation. They have the potential to become cost-competitive under large-scale production and low-cost renewable energy scenarios. Recent geopolitical disruptions – and their direct impact on the global maritime transportation industry – highlight the need to diversify risk by introducing new, clean fuels to the global shipping market that can be produced across a wide range of economies. As strengthening supply chain resilience and stabilising transportation costs become increasingly important, e-fuels offer a promising pathway forward, if initial market barriers can be overcome. Unfortunately, major barriers remain, including high fuel costs, limited long-term demand visibility, and the challenge of attracting investment for planned production capacity.

By combining two currently separate levers for impact – voluntary private-sector demand-side action and public-sector market-enabling mechanisms – there is potential to drive faster production scale, cost reduction, and uptake of e-fuels in the maritime industry. To that end, this concept note explores potential new procurement approaches that seek to bring together the respective strengths of two existing initiatives with aligned goals: the Zero Emission Maritime Buyers Alliance (ZEMBA) and H2Global.



Grounded in their combined engagement with governments, fuel producers, vessel owner/operators, cargo owners, and other key supply chain actors over several years, H2Global and ZEMBA have identified three primary barriers to accelerating e-fuel adoption: **(1) the initially high price premium of e-fuels until economies of scale can be achieved; (2) geopolitical volatility that raises costs and undermines business confidence across the global economy; and (3) uncertainty around the design and timing of global regulation to support the maritime clean energy transition.**

The central question addressed in this concept note is whether voluntary public-private collaboration can help achieve initial scale and begin reducing the first barrier now. Doing so would provide the evidence needed to build confidence in the e-fuel pathway, enabling investors and regulators to address the second and third barriers, which fall squarely within their purview.

H2Global and ZEMBA encourage stakeholders to provide input on these initial ideas. In particular, the authors seek engagement from public and private sector actors across the maritime supply chain who are eager to enable decarbonisation and position their organisations as global leaders in the maritime energy transition, but who struggle with practical constraints. Input is strongly encouraged on the feasibility of the pathways described, as well as creative ideas on how they may be improved.

Readers are urged to provide input through the online survey in Section 5. →

2. Context

2.1. Zero Emission Maritime Buyers Alliance (ZEMBA)

ZEMBA is a first-of-its-kind buyers group in the maritime sector with the mission to accelerate commercial deployment of the most scalable clean energy shipping solutions, enable economies of scale for freight buyers (cargo owners) and suppliers, and maximise positive impact beyond what any one freight buyer could accomplish alone. ZEMBA aggregates voluntary demand for in-sector decarbonisation and runs competitive forward procurements to stimulate commercial deployment of scalable, low-emission fuels and technologies. This

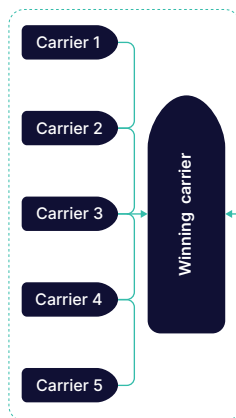
allows ZEMBA members and partner suppliers to demonstrate leadership in deep decarbonisation of an essential global sector. It also creates access to high-quality sustainable maritime fuel certificates (SMFCs) representing verified, high-integrity, in-sector emissions reductions, which corporate customers can confidently claim towards Scope 3 targets under the Science Based Targets Initiative (SBTi) Corporate Net Zero Standard (CNZS) 2.0¹.

Figure 1. ZEMBA voluntary book-and-claim mechanism

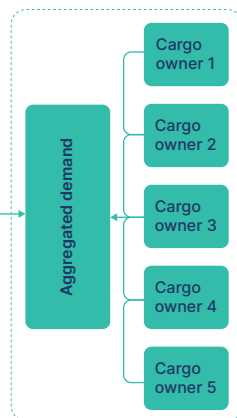
How ZEMBA helps members decarbonise shipping

ZEMBA aggregates cargo-owner demand to accelerate commercial deployment of low- and zero-emission shipping solutions

ZEMBA procurement



ZEMBA demand aggregation



- 1 Aggregates member demand** to strengthen market signalling and gain economies of scale across participating buyers
- 2 Runs forward procurement** for the most scalable low-to zero-emission solutions ready for immediate deployment
- 3 Pre-negotiates bilateral contracts** to safeguard ZEMBA members against price volatility and simplify engagement with the winning carriers
- 4 Provides expert technical guidance** every step of the way on carbon accounting, additionality, and beyond
- 5 Delivers high-integrity, in-sector emissions reductions** through a book-and-claim approach that preserves operational and logistical flexibility

Through binding commitments to purchase SMFCs in future years, ZEMBA members support the uptake of the most scalable, low-emission fuels in the maritime sector by paying only the price premium over fossil fuels, creating a business case for suppliers and thus de-risking the investment required to scale production. ZEMBA members participating in collective procurements are also able to preserve operational flexibility as the SMFCs are delivered through a book-and-claim (B&C) approach,

allowing the investment in maritime decarbonisation to take place independently of a ZEMBA member's specific physical cargo shipments.² This approach unlocks demand for decarbonisation from across a global pool of corporate customers and channels it towards offtake opportunities that meet ambitious technical and commercial criteria aligned with the vision of a net-zero maritime industry by 2050.

¹ The release of SBTi's Corporate Net-Zero Standard V2 was a major milestone for corporate climate action. Most importantly for ZEMBA members and other cargo owners making voluntary investments, the standard explicitly recognises market-based instruments, including SMFCs from B&C systems, as tools companies can use to achieve their science-based targets.

² For more information visit www.shipzemba.org

2.2. H2Global

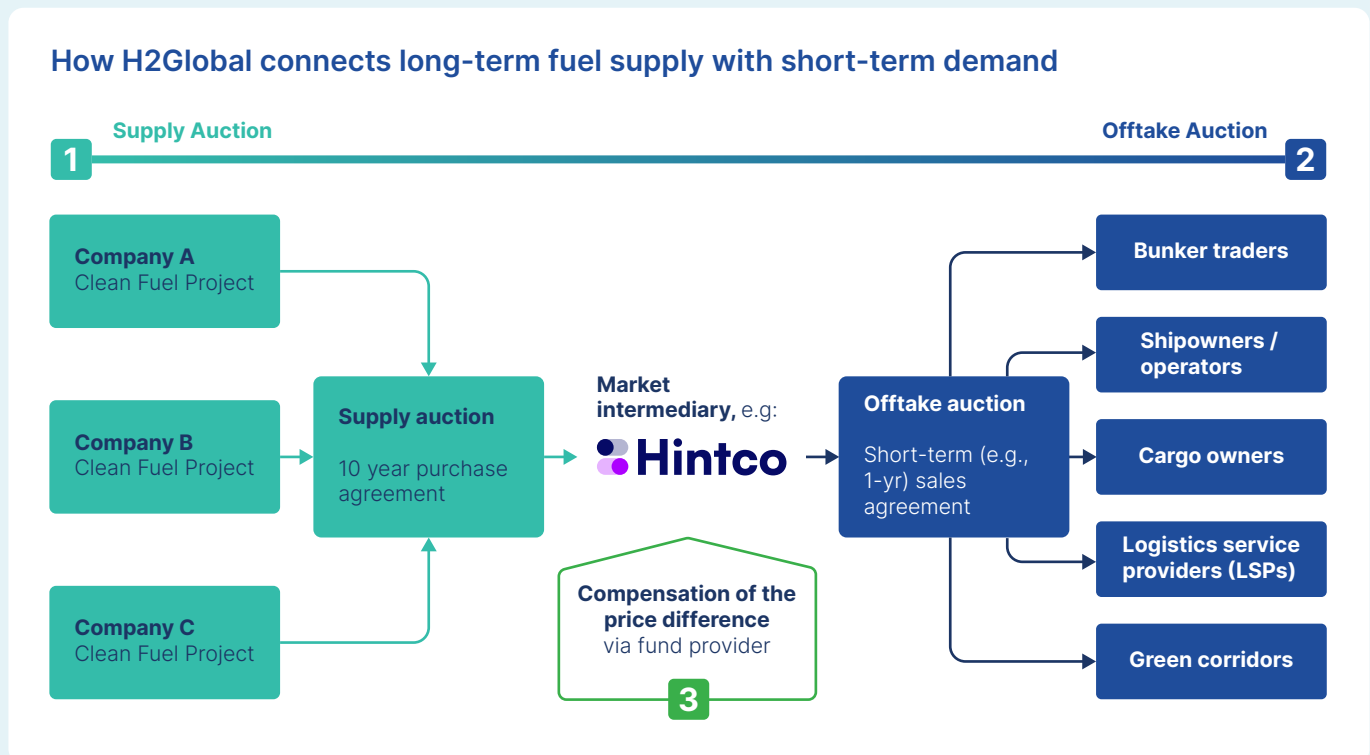
As an international non-profit, the H2Global Foundation accelerates the emergence of global markets for clean hydrogen-based products (such as clean shipping fuels) through innovative financing instruments. Through the H2Global double-sided auction (DSA) mechanism, targeted public funding bridges the price gap between supply and demand. This de-risks clean fuel projects and catalyses private investment.

At the core of the H2Global DSA mechanism is a market intermediary (e.g., Hintco, a wholly owned subsidiary of the H2Global Foundation) that purchases fuels through long-term contracts. This approach provides long-term revenue certainty for fuel producers and enables projects to reach a final investment decision (FID). The intermediary then resells those fuel volumes to offtakers

(purchasers of fuel) through shorter-term contracts, allowing buyers to manage price risk as e-fuel markets mature. Buying and selling are both conducted through competitive auctions that minimise the public funding required to close any remaining cost gap between buyers and suppliers. Fund providers could e.g., be governments or international organisations such as the IMO.

The result is price transparency, secured production and delivery of fuels, and legally binding demand commitments that create confidence for expanding private investment. By sharing lessons from pilot tenders run globally, H2Global also accelerates the emergence of new markets, crowds in private capital, and supports the scalable deployment of clean, sustainable fuels worldwide.³

Figure 2. H2Global Double-Sided Auction (DSA) mechanism



The H2Global DSA mechanism could be applied to e-fuels targeted specifically at the shipping sector. Such de-risking activity is particularly important now as the maritime industry awaits the establishment of a consistent and effective global policy framework that will adequately stimulate the uptake of clean fuels over time.

Governments providing catalytic funding for an H2Global auction have the opportunity to work collaboratively to shape the scope of the procurement around a set of shared objectives. Among other benefits, this can promote the creation of new domestic industries that will be ready to lead when global regulation is ultimately enacted, thus rewarding first-movers.

³ For more information visit www.h2-global.org

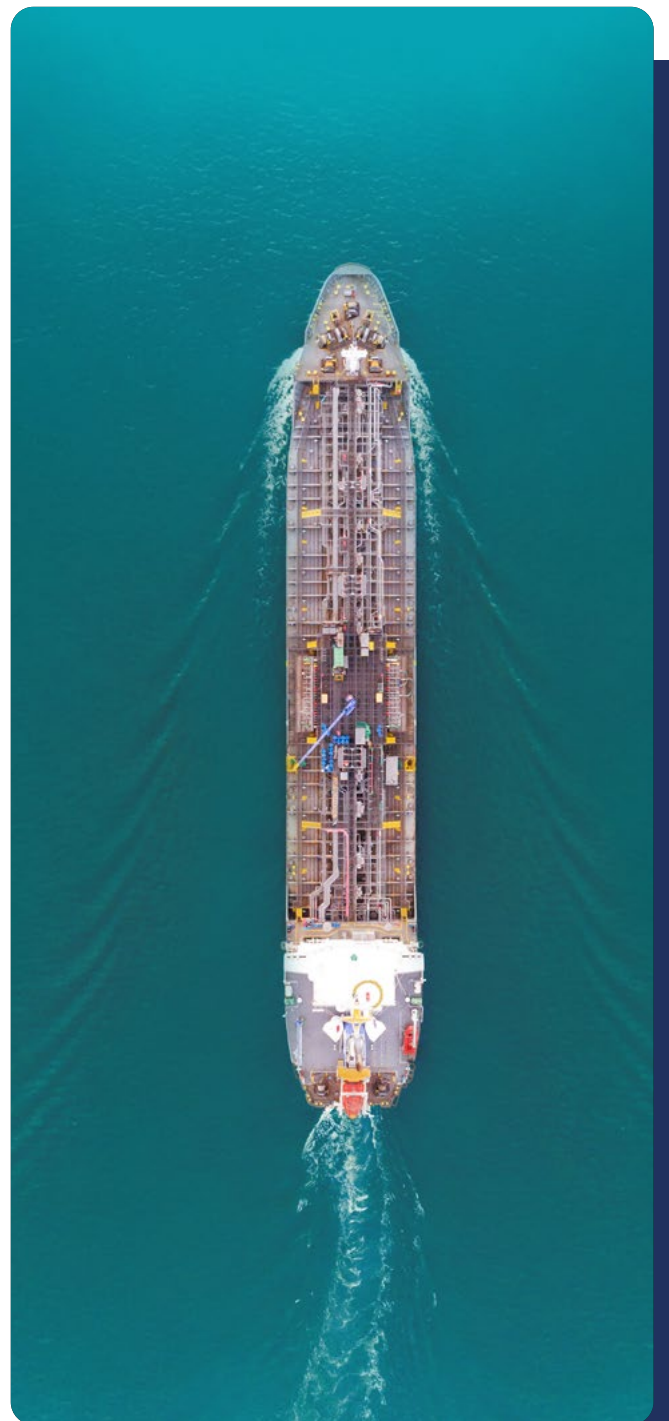
2.3. Synergies between voluntary demand and public support mechanisms

ZEMBA's voluntary demand aggregation and the H2Global DSA mechanism each address a different part of the e-fuel market challenge, and each faces a constraint the other is well placed to address. Understanding today's voluntary willingness to pay (WTP), and its current limits, helps illustrate why. Sustainable maritime fuels (SMFs)⁴ currently have a price premium above the cost of conventional fossil fuel. Some cargo owners individually have a willingness to pay a contribution towards this price premium for the deployment of SMFs. This WTP is manifested in an agreement between the cargo owner and carriers, ultimately taking the form of a purchase contract in which the cargo owner pays a set contribution towards the SMF premium. This contribution, and the resulting cost-sharing between cargo owners and carriers, enables carriers to procure and deploy SMFs within their vessel network at their discretion and allocate the associated emissions benefits to paying cargo owners.

Today, such voluntary decarbonisation purchases are typically made on a year-to-year basis as part of standard freight procurement processes and agreements. ZEMBA has learned that these short-term commitments are neither long enough in duration nor large enough in volume to de-risk the long-term e-fuel offtake agreements that fuel producers require to reach FID and unlock new e-fuel production. This is precisely the gap the H2Global DSA is designed to close: by buying fuel volumes over long durations and selling them on shorter-term contracts, a market intermediary can transform shorter-term voluntary demand into the durable, bankable offtake commitments producers need.

Moreover, the synergy runs in both directions. Voluntary WTP, in turn, can reduce the public funding required per unit of e-fuel in a DSA, allowing limited public resources to unlock larger fuel volumes than either mechanism could achieve alone.

Buying fuel volumes over long durations and selling them on shorter-term contracts, a market intermediary can transform shorter-term voluntary demand into the durable, bankable offtake commitments producers need.



⁴ "Sustainable maritime fuel" is an umbrella term that includes all maritime fuels with lower emissions, including e-fuels and bio-based fuels such as biodiesel, renewable diesel, and biomethane.

3. Potential models for public-private collaboration

Accelerating maritime decarbonisation will require new forms of partnership, such as those proposed in this concept note, that can **create stronger alignment between corporate and public sector action**, particularly with respect to mechanisms that reduce cost and risk and provide durable demand signals for expanded global e-fuel production. This can be done by bringing fuel producers, carriers, and cargo owners together around early transactions that also leverage public funds to close remaining cost gaps. By combining supportive government funding with private WTP, limited public resources can support a greater volume of e-fuel deployment in the maritime sector⁵. This can improve the business case for investment and create the conditions for supply and demand to scale together.

The following section explores how existing public and voluntary mechanisms could be aligned to achieve these outcomes and support the development of scalable clean shipping fuel markets.

3.1. Opportunity to harmonise support mechanisms

ZEMBA's voluntary approach and the H2Global DSA mechanisms operate independently, which could find them supporting the same fuel volumes in parallel⁶, creating inefficiencies⁷. However, when synchronised, they offer a natural opportunity for the public and private sectors to reinforce one another which allows for the following (see **Figure 3**):

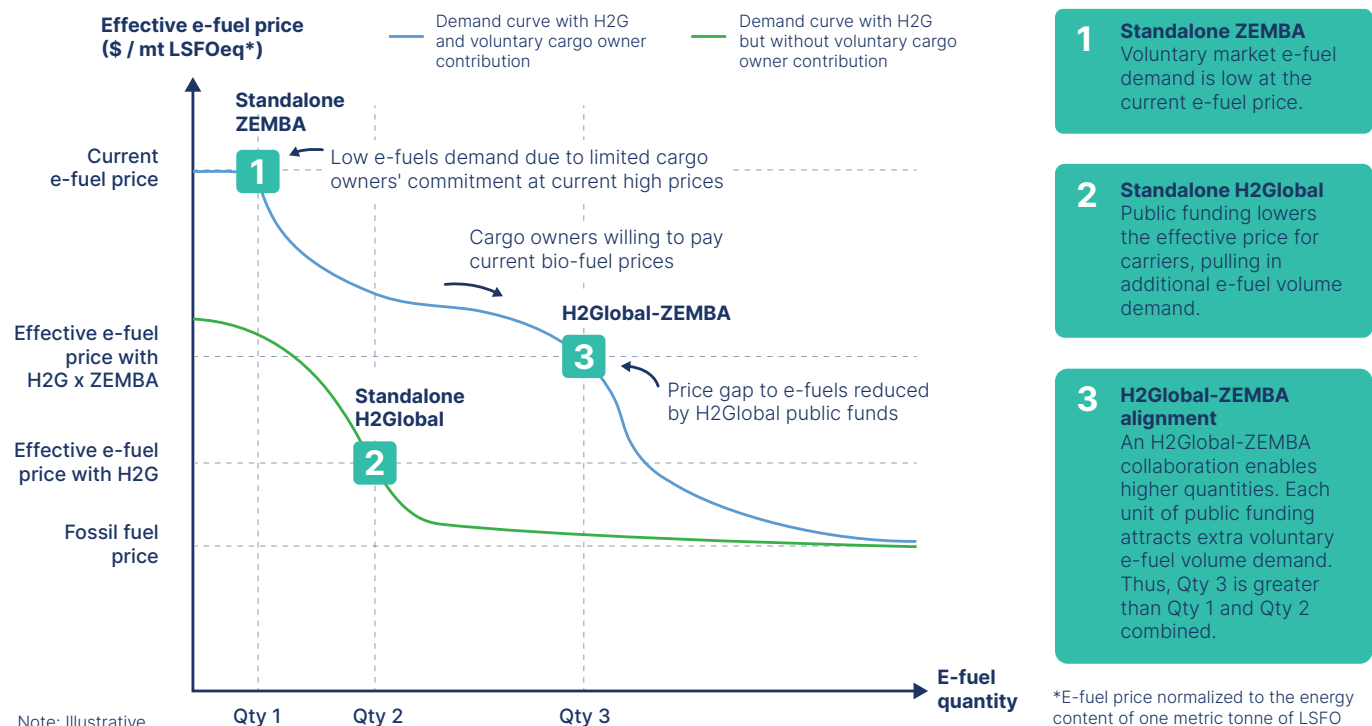
- Public funding can lower the effective e-fuel price towards cargo owners' willingness to pay, engaging more cargo owners than the ZEMBA mechanism alone
- Public funding can then leverage voluntary market contributions to purchase additional e-fuel, thus unlocking greater e-fuel volumes for the same amount of public funding compared to the H2Global mechanism alone

As a result, a H2Global-ZEMBA collaboration could unlock greater e-fuel demand than both mechanisms would create individually.

⁵ From an e-fuel market creation perspective, it may be more appropriate to approach the demand-side auction through a multi-sector approach, marketing the e-fuel purchased to multiple end-use cases and maximising the number of potential bidders. For the purposes of this concept note, it is assumed that the fund provider has targeted shipping as an end-use case for e-fuels. A further discussion of multi-sector versus sector-specific demand-side auctions can be found in the **Appendix D**.

⁶ For example, fuel sold to a carrier in a demand-side auction will likely be used to generate SMFCs sold to voluntary market customers (e.g., cargo owners), who typically contribute the majority of the green premium.

⁷ An example of such an inefficiency would be offtakers' uncertainty of voluntary WTP for the e-fuel purchased on the demand side of a DSA, leading them to underbid in the DSA to minimise risk associated with downstream sales of SMFCs. In this scenario, uncertainty around the total voluntary WTP substitutes limited public funding in place of voluntary contributions, as opposed to a collaborative effort which looks to provide more certainty around voluntary WTP, minimising the unneeded use of public funds.

Figure 3. H2Global and ZEMBA collaboration impact on e-fuel premium and demand

3.2. Overview of collaborative models

ZEMBA and H2Global are considering two potential collaborative mechanisms, which both look to engage voluntary WTP⁸ to maximise e-fuel volumes supported in a DSA.

Figure 4 shows two possible options: Model 1, which involves the organisation of voluntary buyers groups in coordination with carrier bidders in the demand-side auction of a DSA; and Model 2, which enables direct participation of voluntary buyers in a DSA by creating a separate auction for Scope 3 SMFc delivered through a B&C chain-of-custody model⁹.

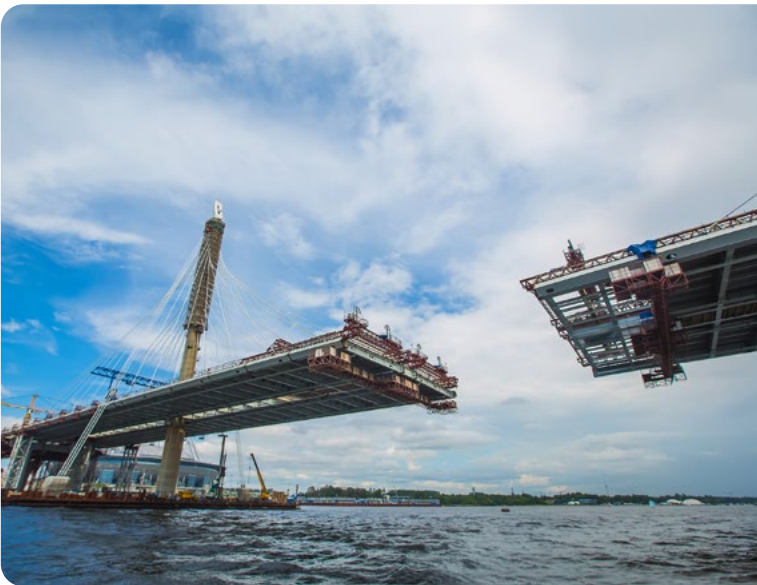
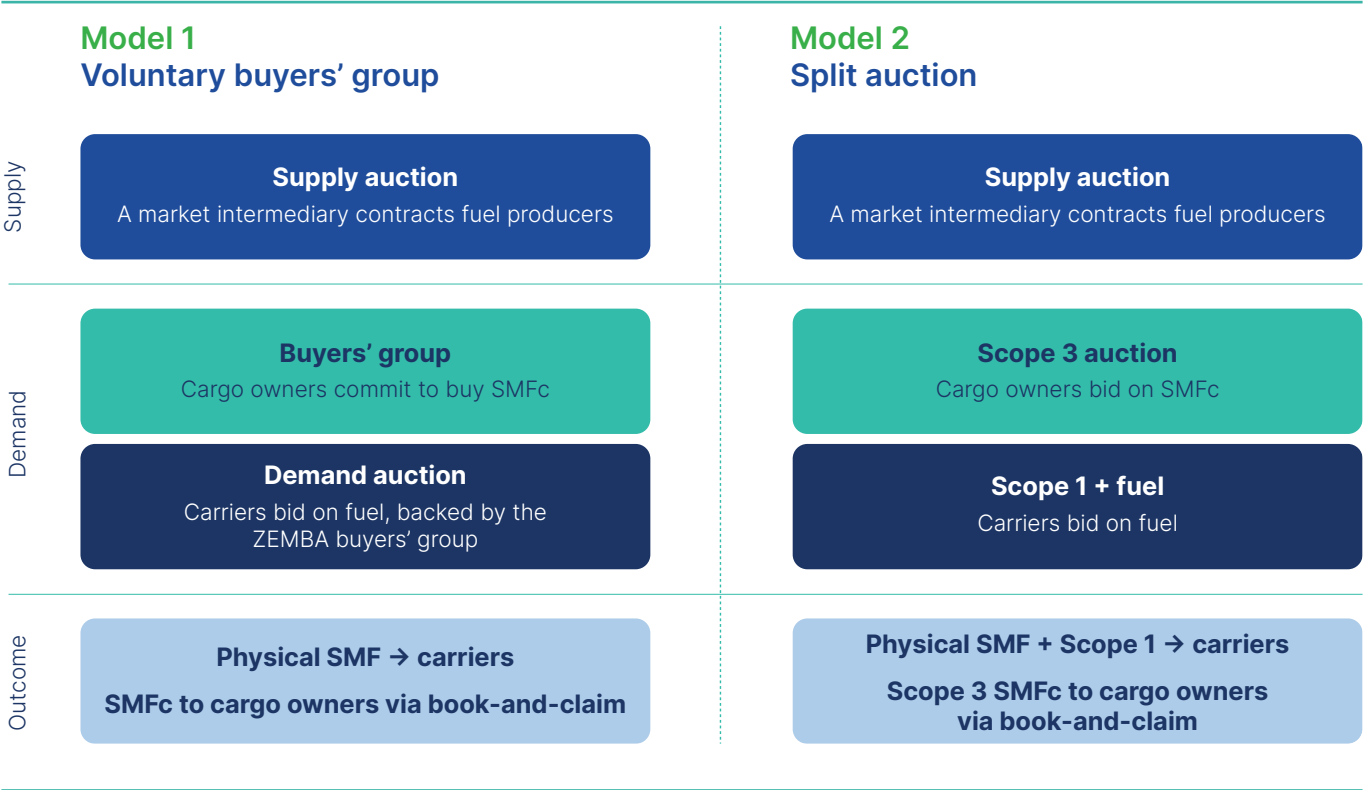
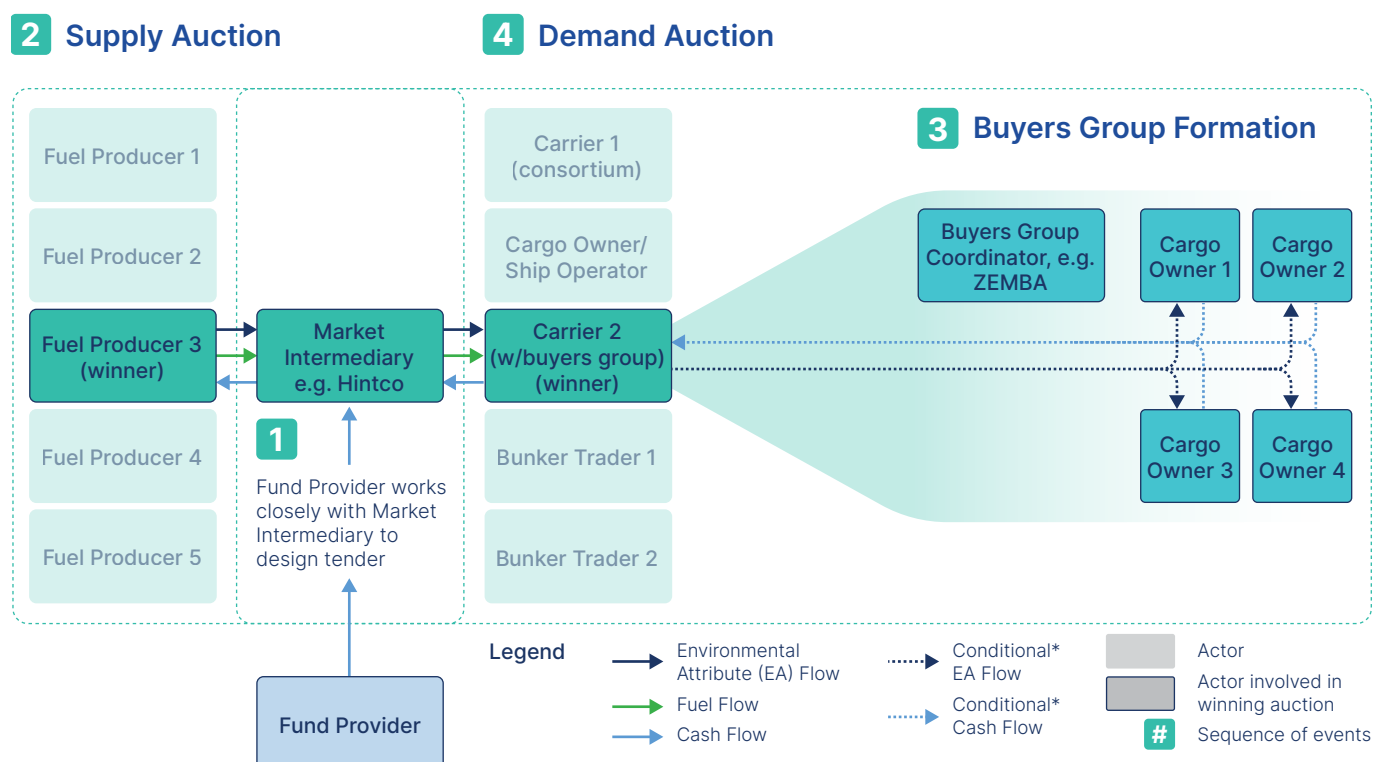


Figure 4. Illustrative collaborative models overview



⁸ Though throughout this concept note the voluntary WTP is referenced as being provided solely by cargo owners, the illustrative models described in this section do not place any restrictions on the types of entities that would be eligible to participate and contribute voluntary WTP.

⁹ A core assumption for Model 2 is that a B&C approach is allowed by voluntary corporate target setting standards as discussed in **Appendix A**.

Figure 5. Illustrative collaborative model 1 – Voluntary Buyers Groups

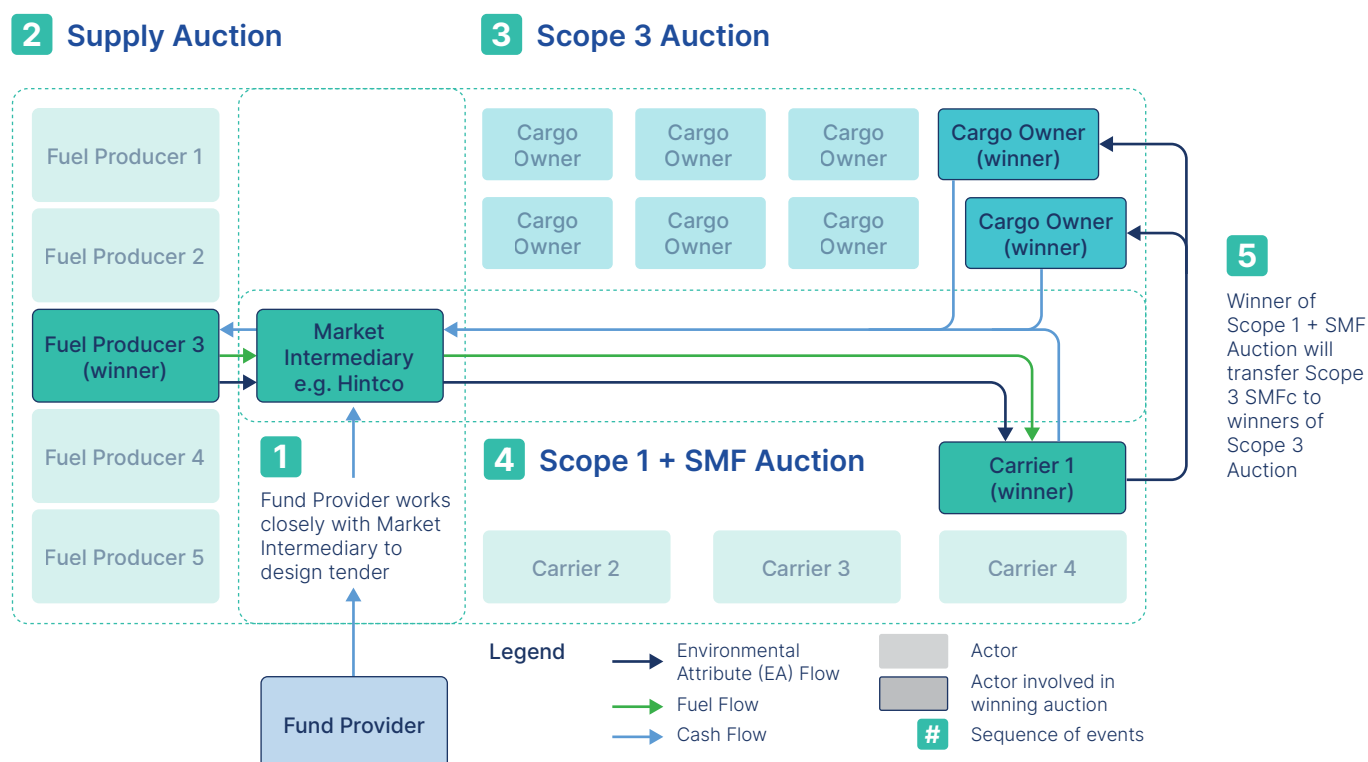
Concept

The Voluntary Buyers Groups model looks to attract voluntary WTP within the traditional structure of a DSA. In the model, the e-fuel purchased by a market intermediary (e.g., Hintco) via the supply-side auction is subsequently auctioned to eligible offtakers, such as carriers or bunker traders, who are seeking e-fuels based on their environmental attributes. In preparation for the demand-side auction, voluntary support for SMFCs can be coordinated through voluntary buyers groups¹⁰ (e.g., ZEMBA) so that voluntary WTP strengthens the offtakers' bids for e-fuels in a demand-side auction.

This model would allow e-fuel offtakers to bid higher for the fuel than if they were taking on the entire risk alone. It would result in a higher total volume of e-fuel deployment than public funding could achieve in isolation, while enabling cargo owners' access to lower-cost e-fuel-based SMFCs than they would achieve if procuring alone.

Appendix C.1 outlines the stakeholder roles involved in developing and executing a tender concept under the Voluntary Buyers Groups model.

¹⁰ Buyers alliances such as ZEMBA are well positioned to organise voluntary buyers groups in this process, but shipping lines and other physical offtakers of the fuel could also form competing buyers groups. Other voluntary market convening organisations could also form buyers groups.

Figure 6. Illustrative collaborative model 2 – Split Auction Model

Concept

The Split Auction model looks to use a B&C chain-of-custody model to allow direct participation in the DSA by entities seeking to purchase Scope 3 SMFc and e-fuel offtakers (i.e., carriers seeking to purchase the e-fuel and associated Scope 1 SMFc). By creating a split auction for Scope 3 SMFc separate from the e-fuel and accompanying

Scope 1 SMFc, a market intermediary (e.g., Hintco) can individually capture and maximise the positive impact of e-fuel premiums willingly paid by both Scope 3 voluntary participants and e-fuel offtakers¹¹, thereby supporting the uptake of larger e-fuel volumes through a DSA.

¹¹ In the Voluntary Buyers Groups model, only the sum of the WTP from carriers and voluntary buyers determines the winner of the demand-side auction. For example, a carrier supported by a buyers group with a high WTP could bid in with a lower carrier-specific WTP and win the demand-side auction over a carrier with a higher WTP but without the support of a buyers group. The Split Auction model allows for maximisation of WTP between carriers and cargo owners in comparison to the Voluntary Buyers Groups model by awarding each stakeholder group based on individual WTP, rather than based on a blended bid in which individual WTP can be obscured by buyers group partners.

In the Split Auction model, after the completion of the supply-side auction, the market intermediary would first hold a demand-side auction for Scope 3 SMFcS for eligible bidders.¹² Once the Scope 3 SMFcS have been auctioned, the market intermediary would hold a subsequent demand-side auction for e-fuel offtake and Scope 1 SMFcS amongst eligible bidders.¹³ The bidders in the e-fuel and Scope 1 SMFcS auction would bid into the DSA, on the condition that as an auction winner, the e-fuel must be used in a shipping application, and that the carrier using the e-fuel would be required to issue SMFcS and transfer them to the winners of the market intermediary's Scope 3 SMFcS demand-side auction.

By creating two separate demand-side auction processes to engage two key buyer groups on the demand side of a DSA, the Split Auction model can achieve two critical outcomes in support of the primary goal of deploying higher quantities of e-fuels:

- Direct engagement through the Scope 3 demand-side auction with new and existing buyer groups (e.g., cargo owners) demonstrating willingness to pay to reduce shipping emissions. Payment for SMFcS would flow from cargo owners directly to the DSA on the condition that SMFcS be delivered by the winning carrier in Step 5 within a certain timeframe/vintage.
- De-risking of the e-fuels purchase for offtakers. Carriers would be able to bid their individual willingness to pay for Scope 1 emissions reductions and the e-fuel¹⁴, with no liability for downstream Scope 3 SMFcS sales as those will have already been secured via the Scope 3 SMFcS demand-side auction.

Appendix **C.2** outlines the stakeholder roles involved in developing and executing a tender concept under the Split Auction model.



¹² Eligible bidders for the Scope 3 auction would be specified in the tender design based on market consultation and close coordination between the public funding provider and the market intermediary; for the purposes of the exhibits in this section, they are assumed to be cargo owners or other entities with Scope 3 shipping emissions.

¹³ Eligible bidders for the Scope 1 auction would be specified in the tender design based on market consultation; for the purposes of this concept note, they are assumed to be ship owners and operators, as they are traditionally the reporting entities for Scope 1 emissions associated with SMFs.

¹⁴ It is assumed that in the absence of Scope 1 or Scope 3 environmental attributes, the remaining value of the e-fuel molecule will be equivalent to the local market price for the conventional fuel equivalent (e.g., low-sulphur fuel oil).

4. Quantification of benefits

To clearly evaluate the pros and cons of any new market-making approaches, it can be useful to consider an example. **Figure 7** summarises an illustrative base scenario (Scenario 1), in which public funds alone support the DSA mechanism, and a

public-private collaboration (Scenario 2), which can increase the total volumes of e-fuels beyond the base scenario. Assumptions and general modelling parameters are noted in the third column.

Figure 7. Illustrative quantification of benefits

Supply-side and demand-side auction results (Scenarios 1 and 2)		Notes
Fund provider contribution	USD 1,000,000,000	Assumption. Disbursed over the length of the e-fuel supply agreement (for example, 10 years)
Supply-side auction winning bid	USD 900/mt e-fuel	Assumption. Includes production cost + delivery to bunker hub
Carrier WTP for physical SMF	USD 255/mt e-fuel	Assumption. LSFO-equivalent price at ~USD 550/mt LSFO

Scenario-specific results	Scenario 1 e-fuel supported only by public funds	Scenario 2 e-fuel supported by both public funds and voluntary WTP	Notes
E-fuel premium by voluntary market customers	USD 118/mt e-fuel ¹⁵	USD 235/mt e-fuel	Assumption. Based on voluntary WTP ~USD 200/mt CO ₂ e reduction
Per unit use of public funds	USD 527/mt e-fuel	USD 410/mt e-fuel	Calculation
Guaranteed production unlocked	111 ktpa		Assuming public funds must cover full price from supply-side auction
Likely production unlocked	190 ktpa	242 ktpa	Assuming e-fuel can be sold for LSFO-equivalent prices

This example reflects broad co-benefits shared by all participating stakeholder groups, including access to e-fuel-based SMFCs at significantly lower premiums for voluntary market customers and de-risking of e-fuel usage by e-fuel offtakers (e.g., carriers). By creating such a win-win situation for all entities involved, public-private collaboration can effectively capture WTP from voluntary market customers.

In the above example, by capturing the WTP from voluntary market entities within an H2Global DSA, the modelled per-unit contribution from public funds can be decreased by ~USD 118/mt e-fuel (~20%), and an additional ~50ktpa (+25%) of e-fuel production capacity can be unlocked.

¹⁵ In this quantification of benefits, the baseline case assumes a contribution by voluntary market customers that is half the contribution of Scenario 2. The underlying assumption is that offtakers may likely engage voluntary market customers to coordinate their WTP— whereas in Scenario 2, the full potential WTP is unlocked.

5. Request for stakeholder feedback

The proposed models above are intended to address key barriers to e-fuel deployment and create win-win scenarios for all parties involved, but the authors acknowledge that stakeholders in different parts of the value chain may have different perspectives. Stakeholders are therefore urged to share their honest views and thoughtful feedback.

ZEMBA and H2Global are seeking general input on the overall concept, as well as specific feedback on several areas critical to implementation, including:

- the relative appeal of the two proposed models;
- stakeholder willingness to participate in such auction-based mechanisms;
- fleet, operational, and bunkering infrastructure readiness; and
- other conditions required to support broader market engagement.

Surveys are tailored to specific stakeholder groups. Please click the survey that applies to you. All input will be taken into consideration.

Please access the relevant survey below:

[Survey for governments →](#)

[Survey for carriers →](#)

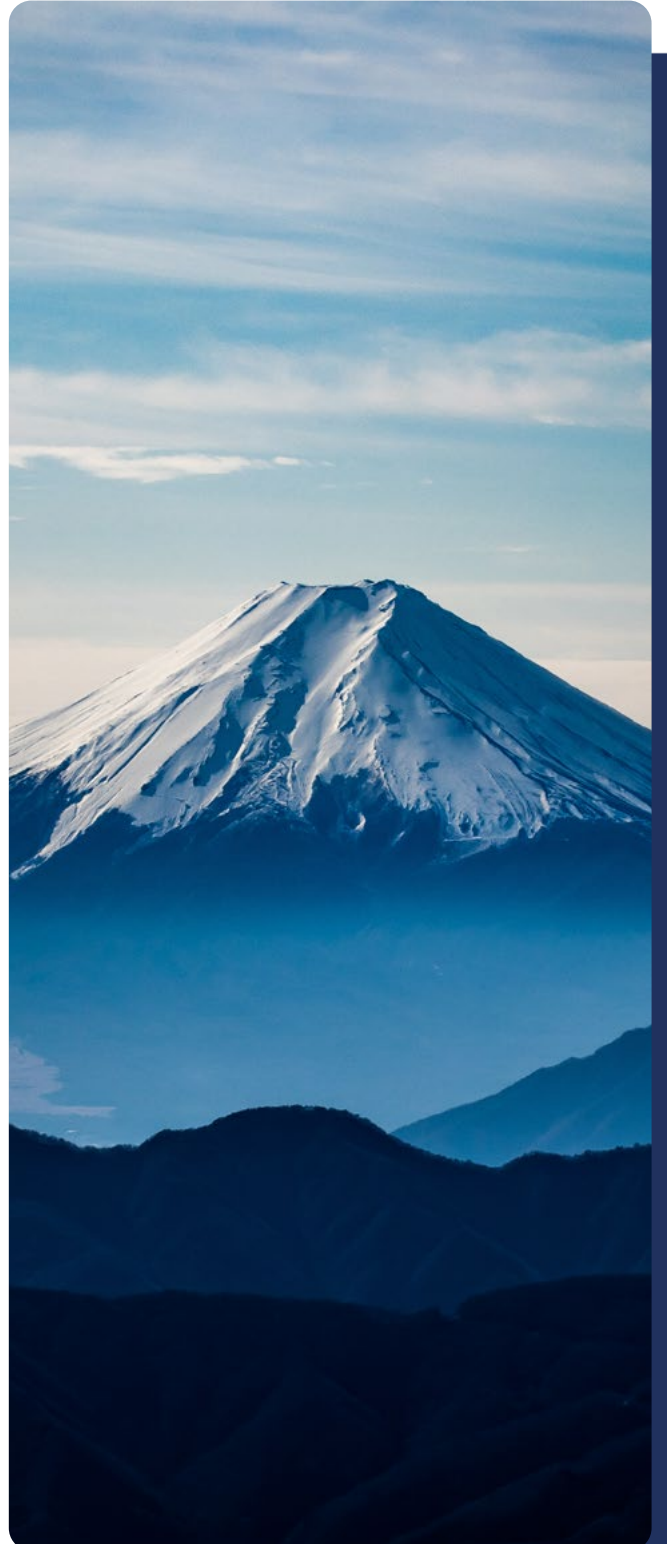
[Survey for cargo owners →](#)

[Survey for fuel producers →](#)

Responses received within six weeks of publication will be prioritised for initial review. Submissions after that point remain welcome and will be considered on a rolling basis. For further questions, please contact:

H2Global: info@h2-global.org or

ZEMBA: info@shipzemba.org



6. Conclusion



The headwinds facing maritime decarbonisation, from rising costs to regulatory uncertainty, require us to consider new forms of collaboration across the maritime ecosystem.

By coming together in the spirit of creative problem-solving, grounded in meaningful input from key maritime stakeholders, the authors aim to overcome these problems and turn initial ideas into practical pathways to accelerate the scaling of e-fuels.

The shared goal must be to drive scale, cost reductions, and stronger market demand so that the many publicly stated 2040 and 2050 decarbonisation goals across the maritime sector can still be achieved. Through collaboration, stakeholders can renew momentum for supportive public policies to be enacted at various scales, attract new private-sector champions to the mission through a solid business case, and accelerate measurable impact.

The opportunity is here. Please join the ZEMBA and H2Global teams as they navigate towards new solutions.

Appendices

Appendix A. Appropriate co-claiming of emissions benefits

All Scope 3 voluntary market standards allow for what can be considered “appropriate co-claiming” of Scope 3 and Scope 1 emissions impacts associated with the generation of SMFcs. This allowance can clearly be seen in criteria C25.6 of the Science Based Targets Initiative (SBTi) Corporate Net Zero Standard (CNZS) v2.0¹⁶, and in Section 5.7.4 of the AIM Platform Standard and Guidance v1.0 (the AIM Standard)¹⁷.

Each collaborative model described in this concept note intends to describe an “appropriate use” of co-claiming emissions benefits associated with the same quantity of fuel. At its core, appropriate co-claiming results from mechanics of GHG accounting across a physical supply chain. Just as a single unit of fossil fuel can appear in multiple GHG emissions reports (e.g., LSFO consumption

appears as a ship operator’s Scope 1 emissions, and appears as a cargo owner’s Scope 3 emissions), the emissions benefits from using SMF instead of fossil fuel can also credibly appear on multiple emissions reports (e.g., lowered Scope 1 emissions for a ship operator, and lowered Scope 3 emissions for the cargo owner).

“Appropriate co-claiming” should be clearly distinguished from inappropriate “double selling”, “double issuance”, or “double claiming” of environmental benefits, which are described in more detail in the AIM Standard¹⁸. The risk of this occurring can be mitigated through proper contractual mechanisms, record-keeping, and assurance processes (as demonstrated to date by procedures and documentation required by ZEMBA and its non-profit registry partner, Katalist¹⁹).

Appendix B. Collaborative model construct

To effectively describe and compare different collaborative models, a uniform set of conditions and assumptions must be applied. This section describes those underlying assumptions.²⁰

Assumption 1 – Fund provider to DSA implements a shipping-specific tender, in which the fuel purchased through the supply auction is required to be used in a maritime use-case within a specified period.²¹

Assumption 2 – Limited regulatory drivers exist to mandate or heavily incentivise the uptake of e-fuels. Though both models would still operate as intended in the presence of regulation impacting e-fuels, considerations such as regulatory additionality, regulatory compliance value of e-fuels, etc., were intentionally not considered for simplicity.²²

¹⁶ Accessible here: The new Corporate Net-Zero Standard Version 2.0 - Science Based Targets Initiative

¹⁷ Accessible here: AIM-Platform_Standard-and-Guidance_V1.0.pdf

¹⁸ Accessible here: AIM-Platform_Standard-and-Guidance_V1.0.pdf, Section 5.7 “Unique Right to Report”

¹⁹ Further information on the Katalist platform can be found here: <https://www.katalist.org/>

²⁰ Significant changes to the underlying conditions can materially impact the success of each model. These conditions are held consistent based on publicly available information and a need to establish the constraints necessary to develop each model. Feedback on these underlying conditions is accepted but should not be the primary focus of any responses.

²¹ The molecules purchased by a market intermediary in a DSA may have end-use value in multiple sectors (e.g., ammonia can be used as a fuel in maritime vessels and in the agriculture sector as fertiliser). A DSA structured to sell into both markets could in theory maximise the efficacy of public funds, but this benefit is also balanced against other goals held by a fund provider.

²² These considerations would be heavily dependent on the regulatory compliance structure of any future regulations, and would have to be managed by the market intermediary on a case-by-case basis.

Assumption 3 – Market conditions for SMF (e.g., SMF uptake and pricing, voluntary market willingness to pay (WTP) remain stable or on a consistent trajectory with market conditions as observed by ZEMBA from 2022–2026.

Assumption 4 – Different groups of stakeholders can represent distinct tranches of WTP for SMF. Each of these tranches is represented in both collaborative models, but the Split Auction model creates a structure in which Tranche 3 is engaged directly rather than translated through a carrier (as is done in the Voluntary Buyers Groups model).

Tranche 1 – WTP for the physical fuel molecule in the absence of environmental attributes.

Tranche 2 – WTP for the Scope 1 SMFc and environmental benefits included in the SMFc that can be claimed by the physical user of the fuel.

Tranche 3 – WTP for the Scope 3 SMFc and the environmental benefits included in the SMFc that can be claimed by the end-user of shipping services generated using the SMFc.

Assumption 5 – All voluntary corporate target-setting standards allow the co-claiming of environmental benefits (Scope 1 and Scope 3) towards achievement of emissions reduction goals. The use of B&C mechanisms is also now accepted under SBTi for the purpose of demonstrating progress towards Scope 3 corporate emissions reduction targets. The reporting of emissions benefits associated with the use of B&C mechanisms within corporate GHG inventories will also be addressed in the coming months by the Greenhouse Gas Protocol (GHGP).

Appendix C. Stakeholder roles in collaborative models

C.1. Stakeholder roles in the Voluntary Buyers Groups model

Stakeholder type	Supply-side auction	Demand-side auction
Fund provider	Determine auction parameters (in close coordination with the market intermediary), including: - market intermediary setup - funding envelope - contract duration - auction / bidding format - bidder eligibility - fuel criteria (fuel type, production location, certification, carbon intensity, feedstocks, etc.) - other performance criteria (production location, delivery location, etc.)	Determine auction parameters (in close coordination with the market intermediary), including: - auction / bidding format - contract duration - bidder eligibility
	Supply public funds to cover the cost gap between the price paid in the supply auction and the price received in the offtake auction on delivery of fuel.	
Market intermediary	Advise fund providers to design auction. Execute a competitive sourcing process to select a winning supplier of the supply auction, including contract negotiations. Sign binding supply agreement for future fuel production and publish the auction clearing price.	Advise fund providers to design auction. Execute a competitive bidding process to select the winners of the offtake auction, incl. contract negotiations. Sign binding offtake agreement for future fuel volumes and publish the auction clearing price.

Stakeholder type	Supply-side auction	Demand-side auction
Ship owners / operators	Participate in transparent public market consultation launched by fund provider to provide input on DSA parameters: • auction / bidding format • willingness to pay • auction design • feasibility assessment of performance criteria (methanol versus ammonia, vessel availability, bunkering ability, location of production and delivery, environmental attributes)	Engage in a competitive auction process, bid to purchase SMF, and offtake the fuel.
Cargo owners		Sign a binding commitment to partner carrier to purchase SMFCs under agreed-upon conditions.
Buyers groups organisers		Organise a voluntary commitment from cargo owners to purchase Scope 3 SMFCs from carriers in advance of the demand-side auction.
Other potential bidders		Engage in a competitive auction process, bid to purchase SMF, and offtake the fuel.

C.2. Stakeholder roles in the Split Auction model

Stakeholder type	Supply-side auction	Scope 3 auction	Scope 1 + fuel auction
Fund provider	Determine auction parameters (in close coordination with the market intermediary), including: • market intermediary setup • funding envelope • contract duration • auction/bidding format • bidder eligibility • fuel criteria (fuel type, production location, certification, carbon intensity, feedstocks, etc.) Other performance criteria (production location, delivery location, etc.)	Determine auction parameters (in close coordination with the market intermediary), including: • auction / bidding format • contract duration • bidder eligibility Supply public funds after the conclusion of both auctions to cover the cost gap between the price paid in the supply auction and the price received in the demand-side auction upon delivery of fuel.	

Stakeholder type	Supply-side auction	Scope 3 auction	Scope 1 + fuel auction
Market Intermediary	Advise fund providers to design auction. Execute a competitive process to select the winning supplier of the supply auction, including contract negotiations. Sign binding supply agreement for future fuel production and publish the auction clearing price.	Advise fund providers to design auction. Execute competitive auction and select winner(s), including contract negotiation. Sign contracts with all winners of Scope 3 auction committing to transfer of Scope 3 SMFcs after Scope 1+ fuel auction.	Advise fund providers to design auction. Execute competitive auction and select winner(s), including contract negotiation. Transfer ownership of SMF to auction winner, with contractual agreement from winner to support the issuance and transfer of Scope 3 SMFcs to the winners of the Scope 3 Auction. Sign binding offtake agreement for future fuel volumes and publish the auction clearing price.
Ship owners / operators	Participate in transparent public market consultation launched by fund provider to provide input on DSA parameters: auction / bidding format auction design willingness to pay Feasibility assessment of performance criteria (methanol vs. ammonia, vessel availability, bunkering ability, location of production and delivery, environmental attributes).	N/A	Engage in a competitive auction process, bid to purchase fuel, and Scope 1 SMFcs. Issue SMFcs and support transfer of SMFcs to the winners of the Scope 3 Auction. Provide input to the market intermediary on demand-side auction parameters.
Voluntary market customers / cargo owners		Engage in a competitive auction process, bid to purchase Scope 3 SMFc. Provide input to market intermediary on demand-side auction parameters.	Provide input to market intermediary on demand-side auction parameters, e.g., bidder eligibility.

Appendix D. Shipping-specific versus multi-sector demand-side auction

The molecules purchased by a market intermediary in a DSA may have end-use value in multiple sectors, e.g., ammonia can be used as a fuel in maritime vessels, in the agriculture sector as a key input to fertiliser, and still other sectors for power production, chemical manufacturing, etc.

A demand-side auction within a DSA structured to sell e-fuel into multiple end-product markets (a multi-sector demand-side auction) could in theory maximise the efficacy of public funds, but this benefit must also be balanced against other goals held by a fund provider.

A DSA with a multi-sector demand-side auction will benefit from	A shipping-specific demand-side auction will benefit from
- Exposure to more bidders, which can potentially raise the purchase price at the demand-side auction and lessen the burden on public funds. - Certain target markets will be willing to pay more for the physical molecule without the environmental benefits (e.g., the shipping sector may only pay the LSFO-equivalent price for ammonia based on energy density, but the agriculture or chemicals sector would likely pay the equivalent price of grey ammonia or methanol). - Fewer market barriers can lead to clearer price signals across sectors, etc. - Broader penetration into global infrastructure systems and commodities markets. - A potentially more “straightforward” approach to the demand-side auction, in which the end-use case is not prescribed and coordination of the voluntary WTP is secondary to value capture for the physical molecule. - As a trade-off, however, this does require the fund provider to be agnostic about the end use of the fuel. A multi-sector demand-side auction may be more fitting to a fund provider whose primary goal is to support domestic e-fuel production rather than the use of e-fuel in a given sector.	- A clear path to coordinating access to the demonstrated WTP in the voluntary market for decarbonised shipping, as market infrastructure, norms, and processes for the contribution of voluntary WTP have already been developed and piloted, and can be concretely planned into the DSA parameters. - Further use and normalisation of e-fuels in the shipping sector for decarbonisation and energy resiliency. The ripple effects of e-fuel consumption in the shipping sector, such as the development of bunkering infrastructure, logistics supply chains, and the development of domestic deployment experience in the maritime sector. - Early action to establish energy resiliency in a sector that is dependent on long-lived capital assets but is essential to regional economic development. - A fund provider would have to consider the trade-off of potentially lower returns from the shipping sector than with other markets with a higher WTP as a result of prescribing shipping as an end-use case.



 **H2Global** Foundation

ZEMBA 
ZERO EMISSION MARITIME BUYERS ALLIANCE