CLEAN ENERGY MARINE HUBS

AN INITIATIVE OF THE CLEAN ENERGY MINISTERIAL

MARITIME INFRASTRUCTURE FOR CLEAN ENERGY COMMODITIES

INSIGHTS FROM PRIVATE SECTOR LEADERS

August 2025

In collaboration with Professor Dr Stefan Ulreich,
University of Applied Sciences, Biberach, Germany

Chair of the Taskforce Renewables of Energy Traders Europe

Commissioned by:

International Chamber of Shipping

Shaping the Future of Shipping

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About CEM-Hubs

The Clean Energy Ministerial Hubs (CEM-Hubs) initiative is a first-of-it-kind partnership between the private sector and governments across the energy-maritime value chain – the International Chamber of Shipping (ICS), the International Association of Ports & Harbors (IAPH) and the Clean Energy Ministerial (CEM), led by governments of Brazil, Canada, China, Greece, Malta, Norway, Panama, Uruguay and the UAE. The International Renewable Energy Agency (IRENA) and the Global Centre for Maritime Decarbonisation (GCMD) support the initiative.

All collaborating to unlock the production, transportation and use of low-carbon fuels for the world at scale.

www.cleanenergyministerial.org

About the International Chamber of Shipping

The International Chamber of Shipping (ICS) is the global trade association representing national shipowners' associations from Asia, Africa, the Americas and Europe and more than 80% of the world merchant fleet. Established in 1921, ICS is concerned with all aspects of maritime affairs particularly maritime safety, environmental protection, maritime law and employment affairs. ICS enjoys consultative status with the UN International Maritime Organization (IMO) and International Labour Organization (ILO).

www.ics-shipping.org

1.EXECUTIVE SUMMARY

This briefing paper provides key industry views, challenges and opportunities with respect to future fuel infrastructure to transport clean energy commodities worldwide.

Private sector CEOs and leaders across the energy-maritime value chain were interviewed and provided high-level input and insights for this briefing paper. Through interviews, the CEOs and private sector leaders shared priorities, challenges and opportunities from the private sector perspectives to help understand what is required to enable a clean energy maritime infrastructure for the transportation of clean energy commodities globally. A total of 18 major international companies contributed to the inaugural consultation.

These leaders have on the ground experience and a critical interest in the energy transition, particularly in developing and using low-carbon fuels. The private sector participants in the study have investment mandates spanning different risk spectrums, including shipping companies, energy companies, port owners and operators, and infrastructure investors across different regions of the world.

This briefing paper provides findings of the lessons learnt and global leaders' insight into what is required to build the infrastructure to transport clean energy commodities via the maritime sector. The findings are key initial recommendations for the Clean Energy Marine Hubs (CEM-Hubs) initiative to develop a blueprint for governments seeking to collaborate in setting up the conditions to enable clean energy hubs worldwide to accelerate the global energy transition.

The Clean Energy Marine Hubs (CEM-Hubs) is a cross-sectoral, public-private Clean Energy Ministerial (CEM) initiative that breaks silos and brings together the energy and maritime sectors to de-risk opportunities to produce, transport and use low-carbon fuels at scale for shipping to transport and use. In short, CEM-Hubs enable a low-carbon fuel value chain for the world.

FOCUS AREAS

Regulation

Substantial efforts are required to unlock from the current pathway and increase the share of alternative fuels in the global fuel mix to support the decarbonisation of hard-to-electrify sectors. A global market design is needed that is supported by global technology, agnostic regulation based on greenhouse gas (GHG) emissions and mutual recognition of international fuel standards. This would be key to accelerate the transition and support fuel risk assessment for insurance and finance processes. Current industry efforts are focused on energy efficiency to reduce fuel consumption.

Demand

The biggest barrier for investment continues to be the lack of long-term contracts (offtakes) and lack of confidence in future demand, despite progress in Asian markets.

The Technology Readiness Levels (TRLs) for investment are not viewed as a problem. Incentivising demand for diverse stakeholders across industries with different asset portfolios creates challenges. Hence, the transition is likely to take decades unless the demand growth and 'infrastructure embedded' challenges are addressed.

Hubs

Maritime infrastructure can be a key enabler for moving clean energy commodities and enable the energy transition if the sum of many cross-sectoral demands can be added in specific locations, i.e. 'hubbing demand'. A coalition of governments and private sector stakeholders across the energy-maritime value chain can kick-start support to concentrate demand through CEM-Hubs at ports.

Key finding 1: Current expectations from industry

- Private sector leaders interviewed do not expect any substantial increase of alternative fuels in the global fuel mix until after 2030-2035. This is due to the current investment pipeline, the amount of time it takes to develop the infrastructure and market conditions. However, policy implementations and market conditions could change for low-carbon fuels to increase their share after this period.
- Investment from CEOs and energy-maritime value chain leaders depends in all cases on the investment size required, local and international long-term regulation, and the economic lifetime of past investments (locking in current progress). The rate of change or low-carbon investment is currently linked to the 'timing of renewing or changing end-of-life assets', limiting the growth pace of alternative fuels.

Key finding 2: Fuel type preferences

- Without clearer demand signals on types of fuels to be used, companies and investors overall have set a diverse preference for different low-carbon fuels with limited scale and tend to choose only one of these fuels (e.g. methanol, ammonia or biofuels), which will hinder scalability.

Key finding 3: Investment barriers

- The biggest barrier for investment is related to the need for long-term contracts (15 years or more) as these fuels have higher cost than conventional, lack of confidence in long-term demand and the establishment of international standards to trade low-carbon fuels. De-risking support by governments is therefore required. Green finance mechanisms are missing an opportunity (e.g. green bonds, climate-related financial support) and are not yet seen as dealmakers for investors interested in low-carbon fuel infrastructure projects.
- The alternative fuel market is expected to become a global market and consequently needs a global design, international standards and transparency. This evolving route to market would be similar to the current global fuel markets for oil, gas and coal. However, CEOs and industry leaders see concerning signals of political fragmentation and fuel availability for specific sectors such as aviation and maritime.

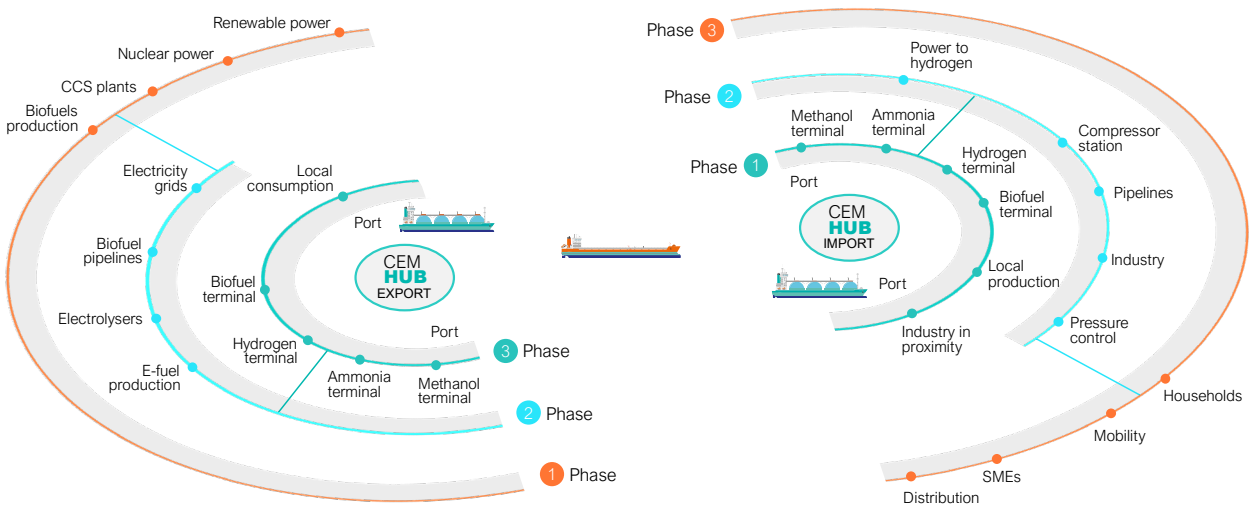
> *"Customers are not willing to pay the higher product prices for green hydrogen in comparison – hence the economics of projects is a challenge.*
>
> CEO Interview

Key finding 4: 'Hubbing' as an enabling solution

- The creation of CEM-Hubs at ports could be a short-term drive for multiple sectors and governments to focus on supporting and developing a collective aggregated low-carbon fuel demand. This would kick-start efforts into CEM-Hubs to develop the maritime infrastructure that enables clean energy commodity trade.
- A coalition of countries and private stakeholders could drive faster progress to make maritime infrastructure an accelerator of the energy transition. Action is required as maritime infrastructure development will take decades to develop for a larger share of alternative fuels in the future global fuel mix.
- Isolated efforts or developing a single hub will not work. Leading countries and key industry stakeholders should support the enabling factors to aggregate demand in multiple hubs.

> *Ideally, export and import hubs will be developed synchronously in various regions, with the strong demand of industrialised areas giving the investment signals. International cooperation and coordination of a few countries with critical size will then kickstart the global development.*
>
> CEO Interview

CLEAN ENERGY MARINE HUBS –
CREATING THE ENABLING INFRASTRUCTURE ECOSYSTEM REQUIRED AT PORTS



CEM Export Hub → CEM Import Hub

SCALING THROUGH MULTIPLE HUBS AGGREGATION OF DEMAND AND SUPPLY OF ALTERNATIVE FUELS

To scale alternative fuel exports at ports for multiple sectors to benefit, substantial development of infrastructure is required in **multiple Hubs (export and import)**

- Safety, future fuel risk assessment and international best practices from industry are key to reduce the risk to increase adoption of these fuels.
- Decision between local consumption and export is driven by economics.
- Transparency and cross-border cooperation are needed, supported by international standards.
- Maritime infrastructure allows excess amounts to export to global markets that would help other regions to decarbonise through imports.
- Electricity grids and large off-grid projects enable large electrolysers and e-fuel production.
- Vast areas can be used to produce alternative fuels with access to a port and export them to densely populated areas.

SURVEY SCOPE AND PARTICIPATION

This CEM-Hubs briefing paper explored industry views, challenges and opportunities regarding future fuel infrastructure to transport clean energy commodities worldwide. A total of 18 major international companies contributed to the inaugural consultation. Through interviews with CEOs and private sector leaders across the energy-maritime value chain, this briefing paper presents the priorities, challenges, opportunities and key recommendations for CEM Ministers identified by the private sector leaders to enable a clean energy maritime infrastructure for the transportation of clean energy commodities globally.

ACKNOWLEDGEMENTS

We are grateful to Mr Esben Poulsson, chair private sector Advisory Group of the CEM-Hubs, and to the following organisations and their leaders to for providing input for this briefing paper:

- BP, United Kingdom
- CEFIC, Belgium
- E. ON, Germany
- Engie, France
- En2X, Germany
- Equinor, Norway
- Fafalios, Greece
- Fleet Management Ltd., Hong Kong
- Hamburg Port Authority, Germany
- HIF Global, Chile
- Höegh Autoliners, Norway
- North Standard, United Kingdom
- Pacific Basin Shipping, Hong Kong
- Port of Açu, Brazil
- SEFE, Germany
- Sohar Port, Oman
- Uniper, Germany
- XPF, Singapore

2. CALL TO ACTION

Within the framework of the CEM and for the purposes of this briefing paper, industry leaders provided key recommendations to the CEM energy ministers, in coordination with transport ministers, to drive forward the global ramp-up of alternative fuels for mobility and industry.

CEOs and industry leaders formulated these collective recommendations in a cooperative, technology-neutral and globally fair manner - with a view to address climate protection, safety concerns, security of supply, market development and infrastructure development.

The CEM can play a central, supportive role in the transformation of the global maritime infrastructure to accelerate the energy transition and support clean energy supply chains. This can be accomplished by the CEM's ability to connect government energy and infrastructure planning, industry recommendations and key global trade stakeholders in alternative fuels.

This is not just about technical expansion and physical infrastructure, but also about regulation, investment and cooperation to enable smooth, cost-effective and safe trade in these low-carbon fuels.

CEM members, associated countries and initiatives have an opportunity to play a decisive role in shaping global trade in alternative fuels by acting as a bridge between political, economic and technological actors for deployment.

Recommendation 1

Policy makers should focus on triggering demand for alternative fuels and its infrastructure over supply incentives which have higher risk and low effectiveness (e.g. reduced taxes for zero-carbon fuels or a quota system).

The supply part of the value chain is ready to invest if sufficient stable demand is there. TRL is sufficiently high to allow for investments on the supply side, while research is still needed it is not the key priority.

Recommendation 2

Policy makers should focus on affordability and security of supply and develop clear and reliable frameworks that allow industries to coordinate their efforts.

Technological openness, transparency and international cooperation, particularly on setting mutual recognition of standards, will be critical to accelerate the transition.

Recommendation 3

Countries should start building a coalition of the willing with a clear common agenda to promote cross-border projects with coordinated market ramp-up strategies. This will support infrastructure readiness for low-carbon fuels to enhance security of supply and enable faster demand growth. This should be a common initiative with industry participation.

The development of the global market for alternative fuels, both as feedstock and as energy carrier, will take place at different paces depending on the fuel type and the region. Currently, most of the production is in proximity to consumption jurisdictions, however, this could change in the near future with multiple of the 29 CEM member countries participating in the future fuels market. Additionally, a reconfiguration of value chains might result because of CEM-Hubs located in the global south delivering not only alternative fuels but increasingly semi-finished products to the global markets.

Today's world is deeply interconnected with its trading flows, with energy especially, its relation to critical materials and to electronics. Global trade helps to mitigate the risks of supply concentration and facilitate movement of energy commodities, especially with the flexibility that the maritime infrastructure provides. For fossil fuels, maritime transport led to a relatively easy replacement of suppliers when crisis occurred, despite potential economic costs. Nevertheless, markets can react extremely quickly to disruptive changes, as seen during the recent gas supply crisis. Similar can be expected for alternative fuels, which can help to maintain a sufficient high level of security of supply but requires efforts to develop its maritime infrastructure at scale in different regions of the world.

3. INVESTMENT LANDSCAPE

The current global infrastructure is the result of multiple decades of long and continuous optimisation along all parts of the value chain. Consequently, the addition of alternative fuels to this system is possible as drop-in fuels, however adding new alternative fuels with higher volumes may require substantial investment requirements and result in potential changes across the value chain.

Alternative fuels can be added by leveraging the current fossil fuel infrastructure (allowing the unchanged use of assets along the whole value chain). However, if different alternative fuels and higher volumes of these fuels are added, a major stepwise investment would be needed to replace parts or potentially a large part of the value chain. Furthermore, a more radical transformation of a substantial fuel uptake could include using more semi-finished products in the value chain, not just the transportation of alternative fuels.

Blending allows the ongoing use of current infrastructure and plants, and so sustains the economic lifetime of current assets. A more radical implementation of alternative fuels approach will require massive investment needs and lead to devaluation of existing infrastructure. It could also lead to a completely new fuel value chain.

> ***Clean Energy Hubs will become industrial centres and benefit from the ability to trade with alternative commodities as well as with semifinished and finished goods.***
>
> CEO interview

The investment appetite from investors depends in all cases on the size of the investments and the economic lifetime of past investments and assets.

Stakeholders with a portfolio of small and modular assets can invest rather frequently to achieve a gradual change in their portfolio and increase the share of alternative fuels gradually. Other stakeholders with a few but large assets can do their replacement investments only in longer time steps leading to a very stepwise increase in the alternative fuel infrastructure. For the overall infrastructure ramp-up, the slowest part of the value chain will determine the overall development. This also indicates why organisations with big portfolios can more easily invest.

Interviewees stated that investments are driven by capital costs (CAPEX) and operating costs (OPEX). The OPEX could be controlled in a easier way, as the more modular the plants are, the easier they can adjust to the demand. In the event of a long-term commitment, the investor has very limited risk with regards to CAPEX. This might be different with OPEX, especially for e-fuels, where the local electricity costs are typically the most volatile contribution.

This risk can be mitigated by grid-independent power supply, e.g. with an on-site power purchase agreement (PPA). Doing so, the power costs typically experience very low or even zero grid fees, much lower taxation and very predictable generation costs. However, this needs the coordination of several industrial players. Similarly, a blue hub would need coordination with carbon capture utilisation and storage (CCUS) activities.

Interviewees highlighted that these investments need to be coordinated, since a completely new value chain needs to be established. Hence, concentrating on single parts of the ecosystem is not helping, but the whole value chain needs to be considered. Regulation needs to change from a project-based view to an ecosystem-based view. The transition diagram below highlights the mutual interdependence in value chains. Drop-in fuels only need a change in the first part of the value chain and can be used to kick-start the process of adoption. Non-drop-in fuels, however, require completely new infrastructure in all parts of the value chain and existing infrastructure would have very limited use.

INVESTMENT OF NEW INFRASTRUCTURE TO TRANSITION FROM FOSSIL FUELS IN DIFFERENT FUEL PATHWAYS

Current fossil fuel-based pathway	Oil, gas, coal (Extraction)	Refineries & fossil processing	Port infrastructure, pipelines, tankers, fuel depots	Industrial delivery, petrol stations	End use: industry, heating, cars, trucks, ships, planes
Easier integration: drop-in commodities allow for a smooth transition. Hydrogen can replace conventional inputs without significant modifications to facilities or processes.					
Drop-in fuels pathway	Oil, gas, **new** renewables (Biofuels, e-fuels), **new** nuclear, **new** CCS	Refineries and **adapted** processing	**Existing** port infrastructure, pipelines, tankers, depots	**Existing** industrial delivery, petrol stations	End use: **no change** in equipment
More difficult integration: non-drop-in fuels lead to disruptive changes along the full value chain. **Changing the whole mega chain.**					
Non-drop-in fuels pathway	**New** carbon neutral electricity + water	**New** electrolysers and e-chemical plants	**New** port infrastructure, H_2 pipelines, ammonia/fuel tanks	**New** refuelling and industrial interfaces	**New** end use tech: fuels cells, H_2 burners

Most of the interviewees do not see international demand as a driver for alternative fuel projects yet. In some niches international demand is visible and mainly the existing transport infrastructure is used to meet the demand. Overwhelmingly, local consumption combined with industrial policies to create CEM-Hubs is seen as the major short-term driver. This development will also be driven by the preference of building supply infrastructure in low-cost electricity areas. These are also interesting sites for other electricity-intense industries, where the alternative fuels will also serve as feedstock.

> ***The easiest way to increase the competitive situation for alternative fuels in cars is a tax exemption for the share of alternative fuels. This would help to create a stable demand and to reduce GHG emissions of road transport.***
>
> CEO interview

From CEOs and private sector leaders' points of view, a global market for alternative fuels is expected. Experiences from the LNG market show that this development is driven by huge investments backed by long-term commitments from buyers and sellers. This development is driven by the benefits for buyers and sellers. In a global market, sellers experience security of demand, allowing them to invest in supply infrastructure. Consumers experience security of supply, since there are enough suppliers delivering at prevailing market prices. The supporting infrastructure receives the signals for the investments to ensure global trade. Interviewees highlighted that global regulation could be enormously helpful to give reliable signals, especially when using GHG emissions as the key definition element for pricing. Global markets will also help to increase competition. This will in turn help consumers and trigger technological innovation, allowing alternative fuel suppliers react to reduced market prices.

> ***Global markets react immediately. As soon as distortions can be seen, e.g. undersupply, volumes will be shifted from other suppliers to the undersupplied region, provided the supporting infrastructure is existing.***
>
> CEO interview

4. LEARNING FROM PAST EXPERIENCES WITH THE DEVELOPMENT OF OTHER FUELS (LNG)

Interviewees considered it key to learn from the lessons from the development of other fuels such as LNG when looking at how to advance alternative fuels' development. From this experience, interviewees highlighted that developing a global market for alternative fuels does not only depend on the supply and demand side, but also on the supporting infrastructure.

Creating global infrastructure is typically a multi-project endeavour running several decades. The first commercial LNG plant was built in 1940 and the real scaling of LNG started after some technical improvements in the 1960s.

Since LNG infrastructure has rather long payback times, from an economic point of view, long-term contracts were heavily used to initiate projects. This helped the infrastructure operators to prove the bankability of their projects, and it also allowed LNG buyers to achieve security of supply via a portfolio of long-term contracts with different suppliers. From a trading point of view, long-term contracts are not viewed as instruments of market foreclosure if reselling LNG is permitted.

Additionally, other aspects considered by interviewees include the importance of stable definitions of fuel quality which are an important prerequisite to enable global trading of commodities. Technical criteria describe energy content, pressure etc. These are rather easy to agree on, especially since they are also measurable. Non-technical criteria, which might enter in the bio-LNG definition are often more difficult to agree on and standardise.

The growth of the LNG market in the past decades was primarily assisted by technical criteria. Different views led to various definitions of bio-LNG, where the green quality is typically proven by green certificates.

When new forms of LNG were adopted, for example bio-LNG and e-LNG, both were successfully integrated into the global LNG trading by blending, since the same infrastructure can be used without modifications, i.e. drop-in fuel. This allows almost immediate use of the existing enabling and demand infrastructure and hence an easier increase of alternative fuels. No changes are needed on the consumer side, both for large industrial chemical operations, gas-fired power stations and on much smaller scale for residential heating. Demand is in this case naturally given and only the supply side needs modification. This is important, since the roll out of technologies on the demand side often takes much longer than on the supply side.

> ***We need all alternative fuels in our industrial processes as feedstock i.e. methanol and ammonia and others. Focusing on a single alternative fuel would not be in the interest of our industry.***
>
> CEO interview

In terms of maritime infrastructure, interviewees highlighted the strengths that the maritime markets provide with respect to transport via pipelines. The advantage of having multiple suppliers enhance security of supply and increases access to the fuels. Furthermore, when more suppliers can participate in a global market, it increases competition. This in turn helps both a faster ramp-up of infrastructure and also scalability of volumes, and a potential reduction of fuel costs which improves affordability for multiple sectors to access these fuels.

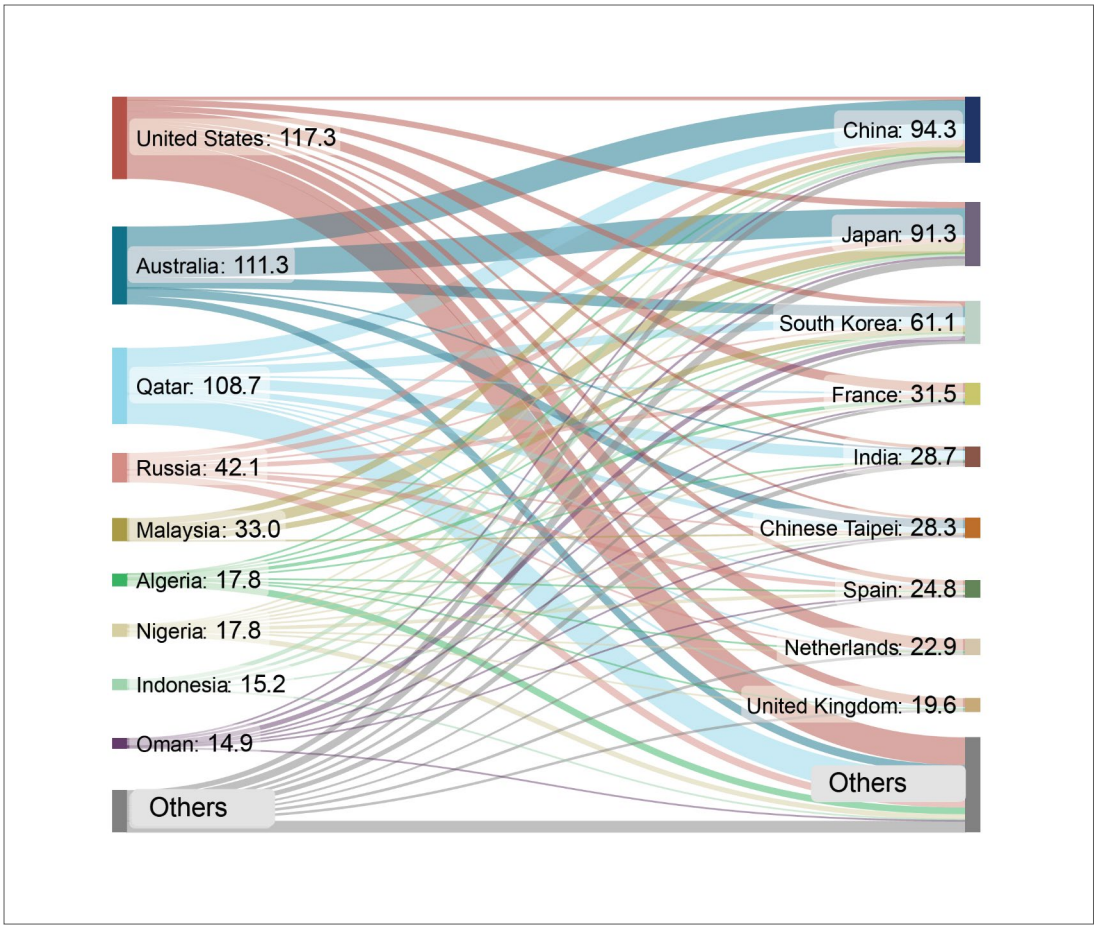
For example, if deliveries are missed by one supplier they can be replaced almost immediately by other suppliers' deliveries. The LNG markets have shown this immediate and reliable reaction in recent years and in very critical situations.

> ***To establish robust demand for alternative fuels, a global regulation that focusses on carbon intensity as the main criteria would be most helpful.***
>
> CEO interview

Interviewees also mentioned the role of ports and the fuel's proximity to the relevant maritime infrastructure. With respect to LNG, the excellent availability of natural gas in proximity to ports makes these sites also attractive for industrial consumers, since ports also allow for easy delivery of other raw materials and easy export of produced goods.

The graph below shows how different countries can address the market to fulfil the import needs of different regions and countries through maritime transportation.

GLOBAL LNG FLOWS FOR TOP NET IMPORTERS AND EXPORTERS 2023 (Bcm)



Source: International Gas Union (IGU) and Rystad Energy, *Global Gas Report 2024*

5. OVERALL INDUSTRY CONSIDERATIONS FOR DEVELOPING A BLUEPRINT FOR TRANSPORTING CLEAN ENERGY COMMODITIES FOR GOVERNMENTS

From the private sector perspective, the leaders that were interviewed listed the key elements governments should be considering when defining a blueprint to advance the development of alternative fuel markets and increase the share and transportation of alternative fuels in the global fuel mix. The list is not exhaustive but represents the collective view of those interviewed for this briefing paper.

Political Framework Conditions and Strategic Coordination

- Demand incentives as priority over supply side support for fuels.
- Binding target paths for alternative fuels (to trigger demand) such as quotas for hydrogen, e-fuels, sustainable aviation fuels (SAFs), ammonia in aviation, shipping, heavy goods vehicles and industry.
- Tax exemption incentives to stimulate investment, particularly in countries with limited funds to support fuel development projects.
- Coordinated market ramp-up strategies such as joint roadmaps, benchmarks and market indicators.
- Global platform for infrastructure standards and harmonisation of safety, quality and certification standards (filling stations, terminals, standards for SAF, etc.).

Investments and Infrastructure focus

- Coordinate investments for cross-border projects, e.g. large hydrogen/ammonia corridors, import terminals or green export clusters.
- Support for the development of global transportation and distribution networks such as international pipelines, port expansion, hydrogen backbones and e-fuel bunker infrastructure.
- Strengthen public procurement with long-term contracts. G20 countries function as “anchor customers” for alternative fuels, e.g. in state fleets, railroads, airlines or steel contracts.
- Long-term contracts ensure bankability, in order not to suppress market liquidity, reselling should be allowed.
- Best practices and recognition of future fuel risk assessments to support de-risking of investments.

Regulation and Certification

- Introduction of an internationally recognised certificate system.
- Traceability of sustainable origin ('Guarantees of Origin' for hydrogen or 'Book & Claim' for SAF) ideally these are based on very simple key performance indicators such as carbon dioxide footprint wake-to-wheel.
- Harmonisation of carbon dioxide pricing and climate tariffs (global solutions).
- International standards (ISO, ICAO for SAF, IMO for marine fuels) that prevent distortions of competition and create fair conditions for climate neutral products.
- Work with insurance industry so projects can be insured accordingly to their risk assessment.
- Repurpose fossil subsidies to focus on demand for net-zero fuels.
- Reprioritise government funding in favour of clean energy and fuel sources.
- Regulation and political signals that enable private long-term supply contracts (PPAs, offtake agreements).

International Partnerships and Justice

- Strengthening global energy partnerships between countries and regions, particularly with the global south.
- Access to technology, training, financing and sales markets.
- Ensuring fair value creation in exporting countries. Local employment, environmental protection, participation in added value.
- Technological cooperation and knowledge transfer.
- Joint research projects, joint standards for production processes, such as for electrolysers.

Innovation and Research

- Joint research and development initiatives for new fuels and applications. Promotion of next-gen technologies such as liquid hydrogen carriers, liquid organic hydrogen carriers, advanced SAFs and solid oxide fuel cells.
- Promotion of cross-sectoral pilot projects like green corridors for shipping, steelworks and chemical industry along export/import axes.

Transparency and Monitoring

- Establishment of a G20 monitoring system for alternative fuels to enhance transparency of supply and demand projects.
- Comparable data on production, trade and sustainability.
- Publication of an annual progress report, *CEM Global Fuel Transition Report*, with best practices and recommendations for action.

6. CONCLUSION

Industry leaders highlighted learnings from other fuels such as LNG or biomass as examples for developing the market of other alternative fuels. In fact, it is expected that the new alternative fuel ecosystem would need decades to be established, especially since the existing fossil ecosystem (oil, gas, coal) is still efficiently providing the majority share of energy commodities via global trading. However, the CEOs and private sector leaders see an opportunity for action where governments can lead with respect to regulation and international cooperation that can catalyse change.

The view of economic leaders highlighted the enormous complexity of establishing a reliable and efficient ecosystem for alternative fuels. It requires good coordination between supply, supporting demand and infrastructure development between the typical exporting and importing regions. Industry representations provided key recommendations from industry to kick-start the process.

A predictable long-term demand for alternative fuels will significantly help to ensure long-term stability for investments along the full value chain and thus trigger further investments in supply and enabling infrastructure. Moreover, standards for fuels, rules for safety and regulation are needed to establish a stable ecosystem. There was a unanimous conviction in the interviews that the more stable the regulation is and its concentration on GHG emissions as a key element for carbon pricing, the more impact it would have globally as well as being technology agnostic.

Nevertheless, implementing the global ecosystem takes time. Change could begin with a few ports transforming into CEM-Hubs that could aggregate demand from different sectors in one location. Although, to see real impact private sector leaders expect that a coalition of governments and industry could support in establishing the conditions for multiple ports to transform into CEM-Hubs in a cooperative manner.

Alternative fuels are also seen as inevitable for a climate-friendly economy. Electrification will in many cases be a preferred solution, but not all use-cases can be electrified. Consequently, parts of the industry and some households need alternative fuels to reduce their GHG emissions. Interviewees made it clear that industry leaders expect a multifuel future as companies may focus on investing on a single fuel, but not all of them on the same fuel.

Furthermore, CEOs and private sector leaders call on governments to focus on providing clear frameworks to incentivise demand and promote global regulation with international fuel standards.

In the long run, this should lead to CEM-Hubs in ports with easy access to cheap electricity production and hence also competitive alternative fuels production in their proximity, where other raw materials can be transported to. This reshaping of global value chains will result in changes for maritime industry. Potentially less energy commodities and more goods will be transported.

Finally, industry leaders highlighted that developing a global market for alternative fuels does not only depends on the supply and demand side, but also on the supporting infrastructure. Successful cooperative models can be developed by all relevant stakeholders. Their timely roll-out, though, depends crucially on global harmonisation.

This briefing paper with leading private sector views will serve as basis for developing a blueprint for governments interested in taking action towards establishing CEM-Hubs and accelerating the global energy transition through the transportation of clean energy commodities via the maritime sector.