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BUNKERSPOT

BURSTING WITH ENERGY

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Bunkerspot is an integrated news and intelligence service for the international bunker industry. The bi-monthly magazine (a digital and hard copy journal) and 24/7 electronic news service (www.bunkerspot.com) provide highly specific information on all aspects of the marine fuels industry.

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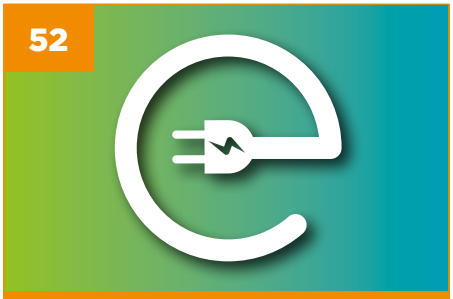
FEATURES

Poland's bunkering sector adapts to changing market dynamics and geopolitical pressures

Mark Watts of LP Brussels weighs up the significance of the recent elections in Europe



Allyson Browne of HACC urges the U.S. to lead the way on port electrification

bunkerspotted...
on page 87

IMO 2020

Don't Use Yesterday's Additives to Treat Today's New Fuels

AMERGY® XLS PLUS
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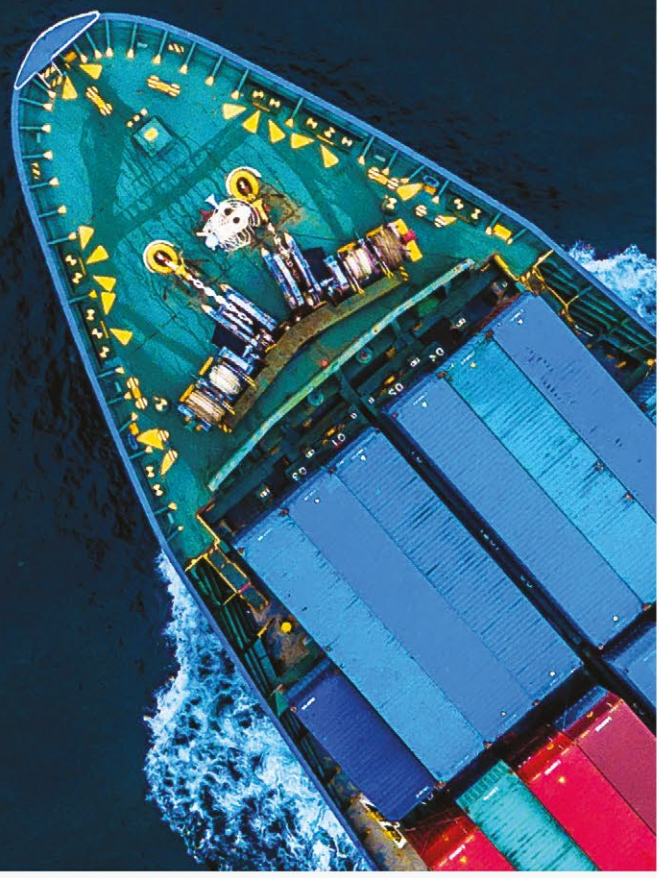

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BUNKERSPOT

comment...

The breadth of articles in this issue of *Bunkerspot* is a telling reflection of just how profoundly shipping and bunkering have changed since our publisher, Petrospot, was first established 21 years ago.

Biofuels are now very much a part of the bunkering mainstream in ports like Singapore and Rotterdam, and the article from FincoEnergies' Johannes Schurmann and ENGINE's Erik Hoffmann (on page 42) shows that there is actually a range of biofuel types and blends on offer – each of which have their own particular characteristics and challenges.

Methanol-fuelled ships are now on the water and more newbuilds and retrofits will be coming out of the shipyards soon. The numbers involved in methanol bunkering – both in terms of ships and fuel volumes – are small and likely to remain so for the next few years at least. Nevertheless, momentum is building and in his article on page 46 Alexander Döll of the Methanol Institute looks at how the use of 'low carbon methanol' for shipping can be scaled up.

Ammonia has some way to go before it can command a serious slice of the bunker market, but many believe that it could be the key marine fuel after 2050. In preparation for this, work is underway to sort out the operational challenges of using ammonia onboard ships, build up the necessary supply infrastructure and, crucially, make it commercially viable and price-competitive with conventional fuels. On page 58, Toni Stojcevski explains how Wärtsilä Marine is developing the engine technology for ammonia and methanol-powered ships and also looks at what can be done to help the new fuels achieve cost parity with their traditional fossil counterparts.

Trelleborg's Andrew Stafford also looks forward to a multi-fuel future in his article on page 50, taking the interesting angle of considering how the industry can build on its past experience of using LNG to smooth the transition to ammonia and methanol.

Alongside the new fuels, we are also seeing a burgeoning interest in the use of shore power to reduce ships' emissions in ports and Allyson Browne of High Ambition Climate Collective examines the programmes now in place for port electrification in the United States on page 52. While shore power is broadly supported within the industry, the necessary infrastructure is not available in many ports – and even when it is, there are other demands on the energy grid. So we will need both to strengthen the grid, and also develop more 'off-grid' capabilities. On page 56, Andreas Bodén of PowerCell Group explains how containerised fuel cells could provide a flexible solution.

Twenty-one years ago, LNG was mentioned as a potential marine fuel – ammonia and methanol, never. There were some battery-powered ships but, like their counterparts in the automotive industry, they were mostly confined to niche sectors. And as for nuclear power… As Steve Simms points out in his article on page 32, nuclear technology has long been an important propulsion option in the naval sector and it has not been *completely* unrepresented in the commercial shipping world. But most readers leafing through their copies of *Bunkerspot* two decades ago would not have envisaged that the magazine would today include an article (on page 38) in which a former IMO Representative of the International Bunker Industry Association (IBIA) – Unni Einemo, now with CORE POWER – would propose that: 'Floating nuclear power plants located at bunkering hubs in green corridors, using only seawater and air to produce carbon-neutral hydrogen and hydrogen-based fuels, could be the ideal solution to meeting demand from the marine fuels market.'

So, this issue of *Bunkerspot* shows how much the 'bunkering' world has changed over the past 21 years – and so have we. Bunkering now encompasses not just a rainbow-palette of fuels but also a host of technologies that all add to the 'ship energy' mix. So it seems fitting that, in the year that the company comes of age, Petrospot is now rebranding as ship.energy.

With the rebrand, the company will continue to publish the world's leading independent bunkering magazine and news portal and host its long-running and much respected industry events, including Maritime Week Americas, ARACON, and Maritime Week Africa, as well as its groundbreaking training courses – the Oxford Bunker Course and BunkerExperience.

But looking forward, there are plans to further grow the company's already strong editorial team, which will report on the 'conventional' bunker market as well as shipping's new energy sources and technologies and always keeping its finger firmly on the pulse of the sector's decarbonisation.

A key lynchpin for the company's own 'energy transition' is the development of a visually exciting and informative new website. To be launched in the autumn, this platform will integrate the existing Petrospot, *Bunkerspot* and ship.energy websites and bring together news, longer reads, podcasts, bunker prices, books, and information on the company's training and conferences for a much-improved user experience.

A number of projects are also in prospect which will both strengthen ship.energy's core skillset and support a focused and exciting new strategic direction for the company as shipping's energy transition accelerates. Through its 21-year history, the company has built up a formidable knowledge of the marine fuels and energy markets and now, as ship.energy, it will only deepen those relationships with bunker and shipping stakeholders as they navigate the energy transition and encounter some of the biggest commercial and operational changes in the industry's history.

Ian Taylor,
Managing Editor,
Bunkerspot

ship.energy

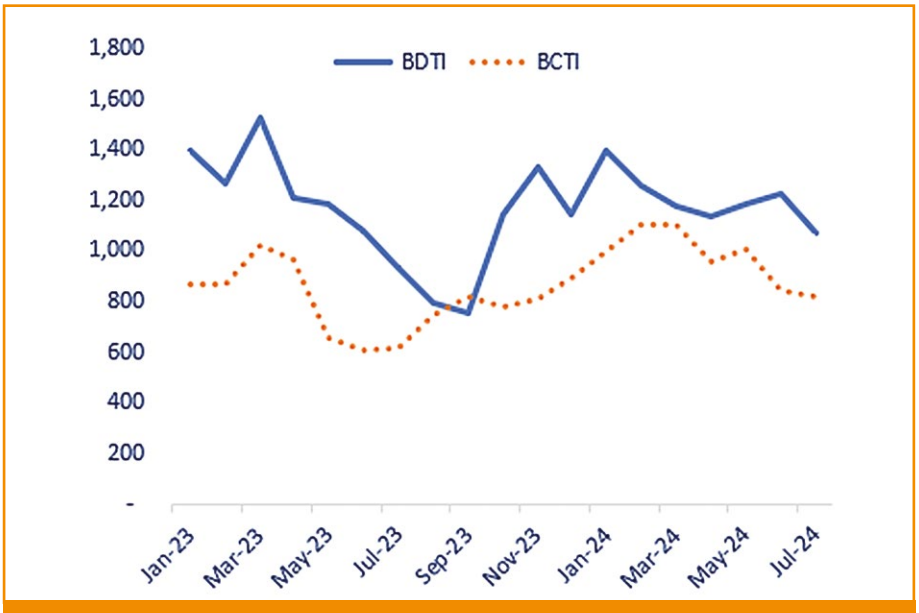
Shipping markets review and outlook

TANKERS

If H1 2024 was a trebles-all-round cashflow bonanza for tanker owners, H2 2024 could be a sober reckoning. Tanker markets rely on Asian crude imports and products exports for long-haul demand. In July, Asian crude imports fell 6.1% compared to June to their lowest level since July 2022, according to LSEG Oil Research. For the first seven months of 2024, Asian oil imports averaged 26.78 million barrels per day (bpd), down 340,000 bpd year on year. Has Asian oil demand peaked? In China, electric vehicles (EVs) were just over 50% of all new vehicle registrations in June, with overall registrations down 6% – it is the oil burners which are not selling. China's total oil imports for H1 2024 were down 11% even as purchases from Atlantic suppliers pushed up overall tonne mile demand for oil tankers. OPEC is still predicting that Chinese oil demand will grow by 760,000 bpd in 2024, India by 230,000 bpd and the rest of Asia by 350,000 bpd. Keep those fingers crossed, boys. Crude oil tanker income was down across the world in July. VLCC earnings averaged $30.5 k / day in July, down from $34.6 k / day in June and $43.2 k / day for H1 2024. Suezmax earnings averaged $38.6 k / day in July after $45.9 k / day in June and $45.5 k / day for H1 2024. Aframaxes averaged $38.6 k / day in July, a big fall from $51.8 k / day in June and from a H1 average of $48.0 k / day. July is usually a seasonal low point for VLCC earnings, so owners will remain optimistic about the second half of the year. Products tanker earnings all fell in July too. LR2s were down a fifth to an average of $29.5 k / day after $35.1 k / day in June and $38.8 k / day in H1 2024. LR1s, so recently the darlings of the market, lost 13% in July, averaging $36.2 k / day after $41.5 k / day in June and $46.8 k / day for H1. The workhorse MR products tanker averaged $32.3 k / day in July after $41.3 k / day in June and $37.5 k / day in H1.

DRY CARGO

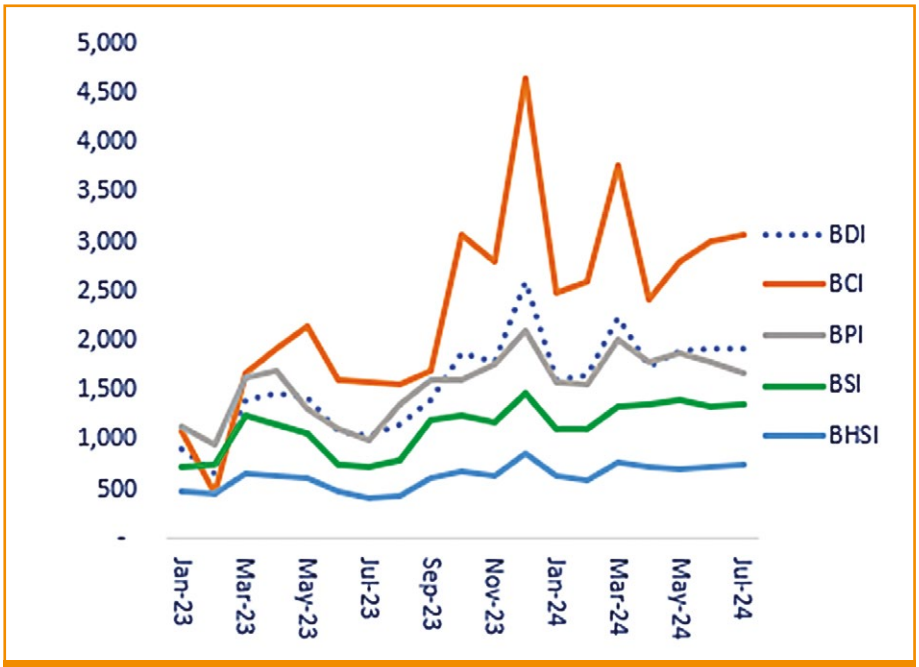
China is the epicentre of demand for bulkers and its July economic data were rubbish. House prices, iron ore prices, steel output, steel prices and retail sales all fell. Deflation ran for a fifth consecutive month, the longest streak since 1999. And yet amid all that, iron ore imports rose 6% in H1 2024 as higher iron content imports won out over domestic production. Moreover, as China expands its sources beyond Brazil and Australia, more iron ore went into Panamax and Ultramax types. Meanwhile, as Asian stock markets corrected on the back of weak US economic data in early August, the prospect of US Federal Reserve interest rate cuts suggests a modestly weaking USD over the balance of 2024. A weaker dollar usually coincides with a stronger dry bulk freight market. The reasons are complex but are based on capital flows in and out of emerging markets. These go up and down with US interest rates. So, even as China struggles to find an economic gear, there are grounds for cautious optimism in bulker freight markets. The bulk carrier freight market rose gently in July. Earnings for Capes averaged $25.5 k / day after $24.9 k / day in June and $23.6 k / day for H1. Panamaxes averaged $15.1 k / day in July after $16.2 k / day in June and $15.9 k / day in H1. Supramaxes averaged $15.0 k / day in July after $14.7 k / day in June and $14.0 k / day in H1. The once humble Handysizes earned an average of $13.5 k / day in July after $13.2 k / day in June and $12.5 k / day in H1 2024. This isn't a bubble, it's better than that – steady earnings growth built on the foundations of constrained fleet supply growth.



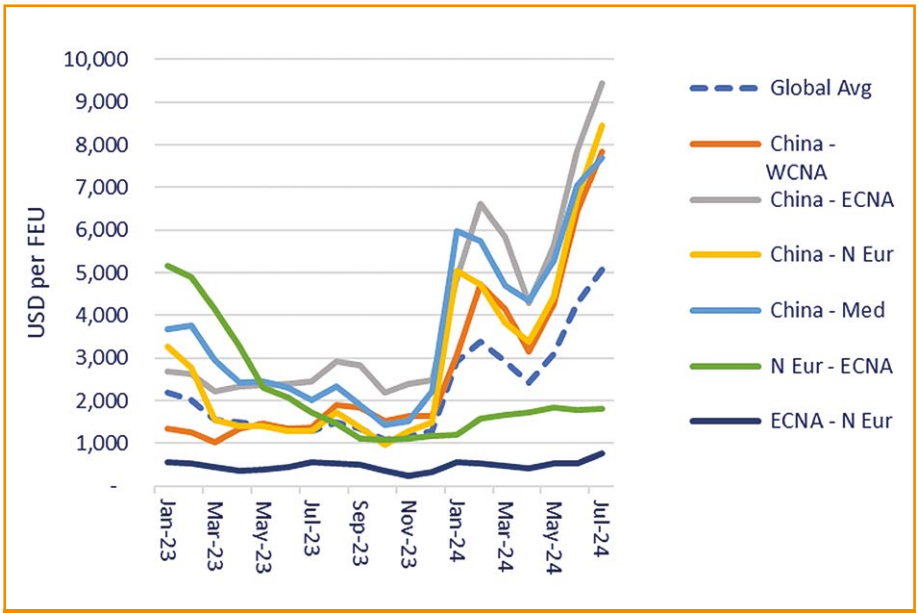
Graph 1: Baltic Dirty and Clean Tanker Indices

CONTAINERS

July has been peak season for container freight rates in the last few years. This year looks set to continue the pattern. Some in the box market think that this year is a super-peak as US retailers build inventory ahead of anticipated increases in import tariffs. Yet, there are macro-economic indicators that suggest change is a-coming. Along with lower US jobs data, we note a reported 31% fall in apparel imports this year to date compared to the peak two years ago along with falls in a variety of household goods imports. Consumers are feeling the pinch. Meanwhile industrial equipment imports are rising, especially for



Graph 2: Baltic Dry Indices



Graph 3: Freightos Baltic Indices

items like solar panels, batteries and electrical equipment, as US policy supports the energy transition and electrification of power systems. China meanwhile notes a change in trade patterns, with exports to Vietnam, Malaysia and South Korea up 21%, 11% and 4% in H1 this year, while trade with the EU was down 4%. China's imports from the US fell 5% while exports to the US grew 1.5%. It looks like regional demand for containerised shipping could grow faster than long-haul demand across the Pacific and from Asia to Europe. Meanwhile freight costs continued their 10 month rising streak in July. On China – WCNA routes, a 40 foot box cost an average of $7,833 to ship in July compared to $6,483 in June and $4,299 averaged over H1. To ship the same box from China to the US east coast via Panama cost an average of $9,450 in July after $7,859 in June and $5,850 in H1. On Asia-Europe, freight rates reached an average of $8,441 per FEU in July compared to $6,768 in June and $4,698 in H1. The mature north Atlantic market was less exuberant. Shipping a 40 foot box from Europe to the US cost $1,800 in July after $1,795 in June and an average of $1,632 in H1. On the reverse route, rates averaged $776 in July, $527 in June and $506 in H1 2024. There are indications as July turns into August that these peaks are beginning to crumble as a further wave of newbuilding container ships joins the market and as US economic growth looks set to slow even as its manufacturers and exporters appear to be doing well. Ship owners with flexible mid-size container ships might be more confident of future employment conditions than owners of the latest and largest ships designed for Asia-Europe voyages.

Mark Williams,
MD, Shipping Strategy and
Contributing Editor, ship.energy

News Focus

In early June, Peter Sand, Chief Analyst at the freight rate benchmarking platform, Xeneta, highlighted that spot container shipping rates were at a level not seen since 2022, when the pandemic was still causing unbounded chaos across deep sea supply chains. Other shipping segments have also been experiencing the 'bounce' of high rates, but while many owners are making hay while the sun shines, even those with the deepest pockets are going to feel a financial chill as environmental regulations begin to bite.

Compliance with the EU Emissions Trading System (ETS) and FuelEU Maritime (FEUM) will come at a heavy price for shipowners and not all trades will be able to pass through costs. Other national ETS proposals are also under discussion, including in China and the UK, and in late July Turkey also joined the ETS queue, with media reports suggesting that a system could be trialled as early as October this year.

While an ETS global web may be a distant prospect on the horizon, when owners begin buying their EU Allowances (EUA) they will no doubt want to know what the EU intends to give back from its coffers for the sector's decarbonisation. In Mark Watts' article for this issue of *Bunkerspot*, looking at the likely impact of the outcomes of recent EU and national elections on decarbonisation strategies, he makes the point that a litmus test of how successfully shipping is integrated into the EU ETS will be whether the industry can secure its fair share of the EU's Innovation Fund. He notes that at least €20 million of ETS allowances will already be allocated to maritime projects under the Fund.

'Everyone is trying to predict the cost of shipping's new fuels but at the moment it really is a back of the envelope exercise'

Although this seems rather a drop in the ocean, given that the Fund is worth €40 billion.

Discussions about the use of market-based measures to 'encourage' shipowners to move to low and zero emission fuels have been underway for ages. The idea of a levy has been batted back and forth at the International Maritime Organization (IMO) for a number of years. It will be revisited at MEPC 82 in October and while progress seems painfully slow there's no question that it would be a complex financial measure to roll out on a fair and equitable basis. One of the problems is that everyone is trying to predict the cost of shipping's new fuels but at the moment it really is a back of the envelope exercise. No one knows – and while that's the state of play, trying to put a $/tonne cost on a levy that would really incentivise shipping to turn away from fossil-based fuels is a thankless task. One of the earliest proponents of a levy, Trafigura, suggested a ballpark figure of $250-$300 per tonne, while back in 2022, Japan put forward $56 per tonne as a base price, which would ratchet up over time.

Coming at the issue from a slightly differ-

ent angle, in late July, the World Shipping Council said it had submitted a proposal about its Green Balance Mechanism – which aims to bridge the price gap between fossil and 'green' marine fuels – for consideration at the IMO's ISWG-GHG 17 and MEPC 82 meetings. Put simply, the greater the GHG reduction a fuel delivers – on a well-to-wake lifecycle basis – the greater the financial allocation a carrier would receive. As explained by the WSC, fees and allocation of funds would be calculated every year, based on the amount of green fuel used and market prices, balancing out the cost across very different fuels.

As with the EU's Innovation Fund and the idea of a global levy already mooted at IMO, the WSC's mechanism includes a proposition to set up an IMO Net-Zero Fund to be used for research, development and demonstration project – as well as climate mitigation initiatives.

But despite these best intentions, there is a startling absence of clarity, even with the EU's Innovation Fund, about how these funds could make their way back to shipowners and who would be the arbiter in the allocation decision-making process.

In the shipbuilding corner of decarbonisation, the banks are supposed to be doing their bit by doling out sustainability-linked loans, but when it comes to assuaging the pain of very high future fuel costs there doesn't seem to be much help out there for owners. If an owner is determined to side with fossil fuels for as long as it can, it will be penalised. But if it plays the good guy and is an earlier adopter of new, clean fuels, it is also hit with a financial cosh. According to some studies, there is a sweet spot along the way where life will become less financially fraught for owners making their journey through the decarbonisation maze, but quite where that spot is...

At the end of July, the European Commission's Directorate-General for Mobility and Transport launched an online platform giving details about the financial tools available to support fleet renewal and retrofitting. According to the EC, this new resource is intended to address the lack of available information on financing opportunities. For those of you who may be thinking of leaving this page to rush to the new platform, prepare to be underwhelmed. It is true that it is a repository of relevant information about EU funding opportunities, along with a couple of links to Societe Generale and Maritime & Merchant Bank, but it's not a ground-breaking resource. As the year moves closer to 2025, a shipowner's options for financial support for the energy transition remain a piecemeal process of subsidies and grants.

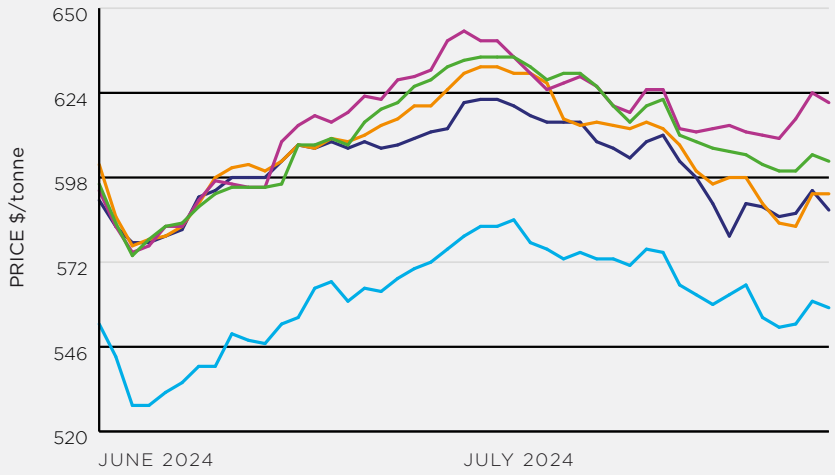
Lesley Bankes-Hughes,
Managing Director, Petrospot

BPi Bunkerspot Price•Index

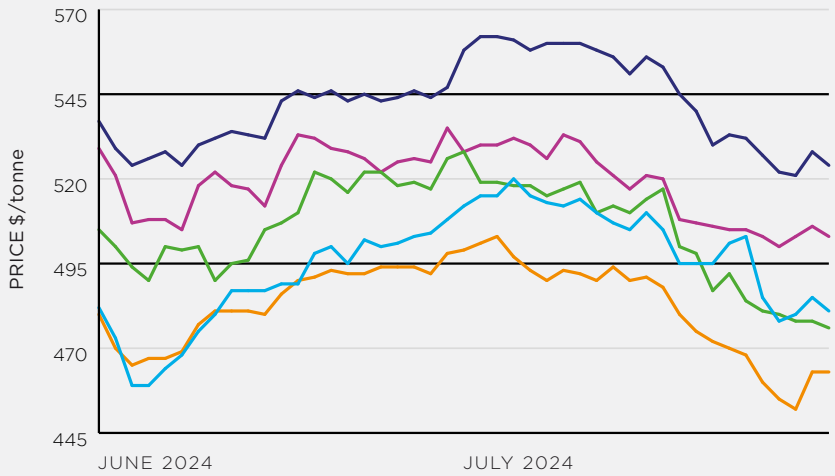
MARKET OVERVIEW

Rotterdam Fujairah Singapore Panama Gibraltar

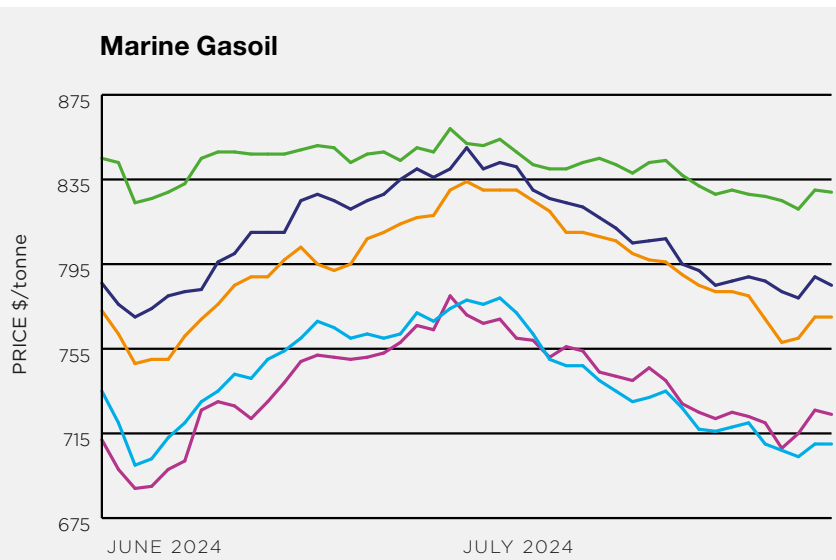
Very Low Sulphur Fuel Oil



High Sulphur Fuel Oil



Marine Gasoil



Hub Watch

Gibraltar

The number of bunker calls at the Port of Gibraltar during the first five months of the year increased by 6%.

A total of 2,009 vessels called for marine fuel at the Mediterranean bunker hub – 114 more than the 1,895 that called during the same period in 2023, according to statistics provided by the Government of Gibraltar.

However, the number of commercial ship-to-ship operations in the period fell from 33 in 2023 to 17 in 2024.

The total number of vessels to call the Port of Gibraltar during the first five months of the year increased from 3,689 in 2023 to 3,767 in 2024.

Total gross tonnage for all vessels slipped from 116,707,458 in 2023 to 113,738,725 in 2024.

Rotterdam

Sales of fossil-based LNG continue to climb at the Port of Rotterdam. A total of 242,931 cubic metres (cbm) was sold in Q2 2024 – the highest quarterly total on record.

Q2 2024's total marked a 12.9% increase on the previous record of 215,247 cbm which was set in Q1 2024.

Fossil-based marine fuel sales volume (2,220,964 tonnes) was 9.7% down on the 2,460,117 tonnes recorded in Q2 2023, although Q2 2024's total marked a 3% increase on the 2,155,877 tonnes that was sold in Q1 2024.

For the second successive quarter, sales of high sulphur fuel oil (HSFO) (825,125 tonnes) surpassed very low sulphur fuel oil (VLSFO) sales (747,300 tonnes) at the European bunker hub.

Elsewhere, sales of ultra-low sulphur fuel oil (ULSFO) (169,953 tonnes) saw y-o-y and quarter-on-quarter (q-o-q) drop offs. Marine gasoil (MGO) sales (260,839 tonnes) rose y-o-y but fell q-o-q. Sales of marine diesel oil (108,428 tonnes) decreased y-o-y and q-o-q.

There were no sales of fossil-based methanol in Q2 2024.

For the first six months of the year, a total of 4,376,841 tonnes of fossil-based marine fuel was sold in the Port of Rotterdam, 12.2% down on the 4,982,389 tonnes recorded in the corresponding period in 2023.

Sales of bio-blended bunker fuel (236,034 tonnes) in Q2 increased y-o-y but slipped q-o-q.

The 158,911 tonnes of bio-blended VLSFO sales was the lowest quarterly total since Q3 2023.

The 34,276 tonnes of bio-blended ULSFO sales was the highest quarterly total ever recorded at the Port of Rotterdam while the 33,371 tonnes of bio-blended HSFO sales was the second-highest total on record behind the 42,761 tonnes that was registered in Q1 2024.

Elsewhere, sales of bio-blended MGO (4,351 tonnes) fell y-o-y and q-o-q. Marine diesel oil (MDO) sales (3,184 tonnes) rose y-o-y but fell q-o-q.

Some 2,200 cbm of bio-blended LNG was sold in the Port of Rotterdam in Q2 2024. This was only the second quarter to register such sales after the 531 cbm that was sold in Q3 2023.

Meanwhile, the 950 tonnes of bio methanol recorded in Q2 2024 means that the Port of Rotterdam has already overtaken the 750 tonnes that was registered for the whole of 2023.

For the first six months of the year, nearly half a million (498,669) tonnes of bio-blended marine fuel was sold in the Port of Rotterdam – 48.8% up on the 335,030 tonnes that was sold in the same period in 2023.

Fossil-based and bio-based bunker fuel sales combined for the first six months of the year reached 4,875,510 tonnes – 8.3% down on the 5,317,419 tonnes that was sold in the corresponding period in 2023.

Singapore

A total of 4,274,915 metric tonnes (mt) of marine fuel (including alternative fuels) was sold in Singapore in June – 8.7% up on the 3,932,910 mt that was recorded in June 2023.

However, June's sales decreased by 11.4% compared to the 4,826,837 mt registered in May, according to preliminary statistics provided by the Maritime and Port Authority of Singapore (MPA).

Sales of both VLSFO – 2,331,100 mt – and HSFO – 1,557, 600 mt – which combined accounted for more than nine out of every 10 mt of bunker fuel sold in Singapore in June, rose y-o-y but slipped month-on-month (m-o-m) at the world's biggest marine fuel hub.

Elsewhere, sales of low sulphur marine gasoil (LSMGO) – 278,800 mt – rose y-o-y but dipped m-o-m. MGO sales – 8,000 mt – saw y-o-y and m-o-m decreases.

In terms of bio-blends, some 45,300 mt of bio-blended VLSFO were sold in Singapore in June – up on 34,300 mt that was sold in June 2023 but down on May's 48,400 mt.

For a second successive month, there were sales of bio-blended HSFO (2,500 mt).

Sales of LNG continue to climb at the Port of Singapore. The 48,800 mt of LNG sales that was registered in May marked a monthly record at the port – and this was broken in June with a total of 51,700 mt.

There were no sales of methanol in June.

For the first six months of the year, a total of 27,197,440 mt of marine fuel was sold in Singapore – a y-o-y increase of 8.5% on the 25,071,190 mt registered in the same period in 2023 – making the port well placed to eclipse the 51,824,000 mt of bunker sales that was recorded for the whole of 2023.

The 3,353 vessels that called for bunkers in June marked the lowest monthly total of the year so far.

A total of 10,107 vessels called Singapore in June.

Panama

Some 385,716 mt of marine fuel were sold in Panama in June – 0.7% up on the 382,955 mt that was recorded in June 2023.

The 235,534 mt of VLSFO that was sold in Panama in June was 14.3% down on the 274,687 mt that was registered in June 2023, according to preliminary statistics provided by the Panama Maritime Authority.

However, there was a marked increase in HSFO sales, which rose 63.9% y-o-y, from 66,784 mt to 109,457 mt.

Elsewhere, sales of LSMGO rose from 31,050 mt in June 2023 to 33,738 mt in June 2024. Conversely, MGO sales slipped y-o-y, from 10,434 mt to 6,987 mt.

June's total did, however, represent a 3.1% decrease on the 398,064 mt of marine fuel that was sold in May.

During the first six months of the year, a total of 2,283,445 mt of marine fuel was sold in Panama – 7.9% down on the 2,479,901 mt that was recorded in the same period in 2023.

The 516 bunker operations marked the highest monthly total of the year so far.

There were 29 bunker barges in operation in June – three fewer than in June 2023 but one more than in May.

As previously reported by *Bunkerspot*, in late June, the Panama Canal Authority announced further transit slots as well as an increase in draft.

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INTERVIEW: DNV's Mikael Johansson: Onboard carbon capture will be one piece of the puzzle for zero-carbon shipping by 2050

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DNV's Head of Maritime Advisory Sweden & Denmark, Mikael Johansson, views onboard carbon capture as one potential pathway for shipping to meet its 2050 environmental targets. Speaking to *Bunkerspot*, he explains how the technology, maligned by some, could play a vital role in helping the maritime sector reduce its environmental footprint at source while continuing to operate at current levels

Do you think that the shipping industry will need to rely on onboard carbon capture technology to meet its decarbonisation goals?

What really has been clear to all of us is that it will not be possible to just change fuel. Regardless, if we talk about biodiesel, ammonia or methanol, we do understand that the cost for these fuels will be expensive solutions for decarbonisation. We also understand that the production of these fuels is dependent on our energy systems as well as potential feedstocks – whether we're talking about fuels like bio-diesel, methanol, ammonia or hydrogen. To only think that we can transition from exactly where we are today into new fuels… that is not the case. The first thing DNV is suggesting is to focus on decreasing the amount of energy that is used and still have the same amount of transportation work carried out (or even more in DNV's predictions because we see that shipping will increase overall on a worldwide basis.) From DNV's point of view that is really the key, all other solutions are extremely costly in all different scenarios. Focusing on energy efficiency here and now will always be the best strategy.

Onboard carbon capture most probably will be a factor in the decarbonisation equation for shipping. We will have to focus on energy efficiency and really exhaust this potential; we will have to focus on having new zero-carbon fuels available and being able to transition towards that, and most probably also combining it with onboard carbon capture for some segments. I think that is the big picture as we see it.

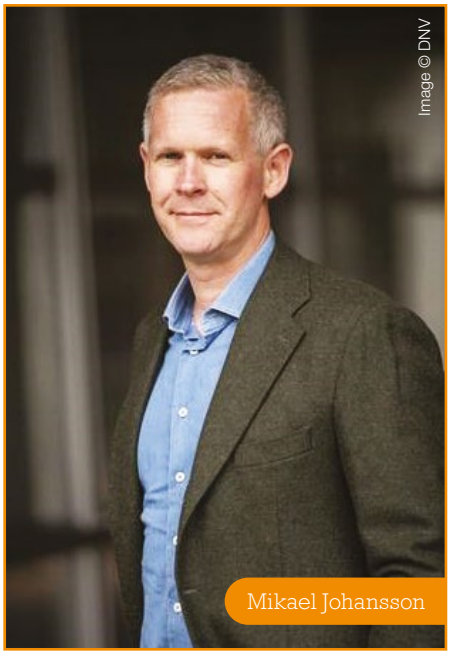

Image © DNV

Mikael Johansson

How would you respond to those who say that onboard carbon capture potentially slows the development of zero-emissions fuels by perpetuating the use of hydrocarbons?

Looking at it from a logical point of view, obviously, if we could move away from fossil hydrocarbons to alternative fuels, that would be the best solution. However, I have a hard time seeing that we will be able to that; that we are able to produce the amount of alternative fuel that is required, and even if we do all the things that can be done when it comes to energy efficiency.

There will still be fossil fuels after 2050, but if we want to use them, we need to make sure that there are feasible and functional solutions for onboard carbon capture. We see now that there are a number of projects initiated in this field. We see that there are a number of suppliers looking at and developing technologies and we see that there are operators looking at OCC as one of the technology paths that needs to be monitored moving forward.

Currently, we have a hard time seeing that there will be enough zero-carbon fuels available. To achieve net zero shipping in 2050 without onboard carbon capture as it looks now seems unrealistic.

How would you sum up the current landscape for the production of new fuels?

As you see from [DNV's Alternative Fuels Insight platform] information, there are a lot of planned projects when it comes to starting to produce different kinds of fuels, including hydrogen that will be a key component in ▶

the fuel production, but very few of them are decided as yet. It will take some time for an investment decision to realise these projects. Looking at the big scale fuel production facilities that are planned in Sweden, they are talking about a timeframe of around four years – and of course, if they don't get the contracts, they will not put the shovel in the ground. And when they put the shovel in the ground, it's four years, give or take, until they can start producing any new fuels at all.

To what extent do you believe that the range of decarbonisation options for the shipping sector is actually hampering large scale production of low-carbon fuels?

We come from a history where we have had a very efficient energy carrier. We were using that for my small boat on a small lake in Sweden and basically the same fuel for the biggest ship in the world. This means that we as an industry have gotten used to always thinking about second-hand value and having assets that are tradable worldwide.

When we move into a new landscape, owners need to take on these decisions in a different manner. If I go down the route of installing sails, will my ship have a second-hand value worldwide in all different trades? Most probably not, even if I install rotor sails. There are specific routes where this is feasible and beneficial, and on other routes they are a useless piece of steel on the ship.

If I go down the route of methanol, will that be available if I'm trading the spot market all over the world? Maybe not in the foreseeable future. So, how do I deal with this as a ship owner, having to take these investment decisions? I think that is causing a lot of discussion. They're not easy questions, and it is causing uncertainty for both shipowners and the fuel producers. When there is uncertainty on the shipowners' side, how can there be certainty on the fuel producers' side? They want to invest in largescale production facilities because small-scale is not financially viable. So, then, they need to have offtake agreements for quite big quantities of fuels that currently people may not want – especially when you compare the price of that fuel to a fossil-based fuel.

How important is regulation – such as the FuelEU Maritime – in helping to kickstart production of new fuels?

From a market point of view, more regulation is seldom a good thing. However, if willingness from end consumers or from the public in general to pay more for goods or shipments that have been transported with a different fuel is not sufficient, we have gone down the route to implement new legislation. We have had the Ship Energy Efficiency Management Plan (SEEMP) and Energy Efficiency Design Index (EEDI) back in 2013 that have been strengthened over the years, but we haven't seen the development that was sought. So, I think where that leaves us as a society is to basically enforce this development by rules and regulation. That is obviously what we see with FuelEU Maritime, which may be the harshest one, where you will have, from a shipping perspective, stringent requirements on what fuels you can use. In the long run, that will drive development and with that development you will drive up the need for new fuels and you will have a better decision basis for taking investments to produce new fuels.

So, from one point of view, more rules and regulations is not the preferred way to market control, but if we see that the market is not self-regulating, it becomes necessary. ■

New well-to-wake study finds ammonia can cut shipping GHG emissions by up to 61%

The first lifecycle greenhouse gas (GHG) emission study on the use of ammonia as a marine fuel, undertaken by Sphera and commissioned by the Society for Gas as a Marine Fuel (SGMF), indicates that ammonia can 'beyond question' contribute significantly to the IMO's GHG reduction targets.

The new report, published in June, uses the latest primary data to assess all major types of marine engines and global sources of supply with data provided by original equipment manufacturers including Wärtsilä, Winterthur Gas & Diesel & MAN Energy Solutions, and also Yara Clean Ammonia and BASF on the supply side.

GHG emissions from the supply chains as well as emissions released during the onboard combustion process (slip) have been included in the analysis. The assessment of the GHG emissions (carbon intensity) of ammonia included the following life cycle phases: production & processing, pipeline transport, liquefaction, ammonia carrier transportation (for imports), ammonia terminal operations (for imports), bunkering and the final combustion in the engine. All ammonia pathways were analysed, including the latest developments with clean ammonia.

Conducted according to International Organization for Standardization (ISO) standards, the study was also reviewed by a panel of independent academic experts from key institutions in France, Germany, and the USA.

Commenting on the findings of the report, SGMF Chairman Tom Strang, who is also Senior Vice President, Maritime Affairs for Carnival Corporation, said: 'This is an important piece of work by SGMF that will help inform the maritime sector on the use of ammonia as a marine fuel and reinforces the importance of working together across all the different decarbonisation pathways, and for me highlights why we are part of SGMF.'

He continued: 'It is important that an independent organisation like SGMF provides quality independent reports such as this latest life cycle assessment (LCA). The industry needs credible information and this is a landmark report as far as ammonia as a marine fuel is concerned.'

Mark Bell, GM for SGMF, added: 'We are confident this work will provide IMO with solid information that will contribute to its regulatory decisions. SGMF will continue to produce up-to-date data, now including ammonia (this study), methanol and hydrogen.'

Dr Oliver Schuller, director of sustainability consulting at Sphera, said: 'The main goal of this study was to provide a fact-based report describing the life cycle GHG emissions on the use of ammonia as a marine fuel across the value chain from well-to-wake. The analysis followed the established international standards ISO 14040/44 on life cycle assessment and underwent a critical review by three independent experts.'

SGMF is one of the partners of the Sustainable Marine Fuel Fest 2024, which is taking place in Porto on 2-3 October. This year's edition of SMF Fest will include focused and dynamic group discussions on a wide range of issues relating to shipping's decarbonisation. Participants will also contribute to the next Sustainable Marine Fuel Confidence Index which was launched in 2023 to provide a unique 'moment in time' overview of industry confidence in shipping's energy transition, according to four key criteria (Technology, Infrastructure, Commercial and Environmental Credentials).

For more information on SMF Fest 2024 and to access the first SMF Confidence Index, visit ship.energy.

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Energy majors rethink biofuel production plans

bp has agreed to acquire Bunge's 50% holding interest in its bp Bunge Bioenergia S.A. joint venture, which will make the international energy major the sole owner of the Brazil-based biofuels-producing company.

Following completion, bp will have the capacity to produce around 50,000 barrels a day (b/d) of ethanol equivalent from sugarcane through bp Bunge Bioenergia's 11 agro-industrial units across five Brazilian states.

In a statement issued in late June, bp said that the deal will 'offer the potential to unlock further growth opportunities in the region, and to develop new platforms for bioenergy such as next generation ethanol, sustainable aviation fuel (SAF) and biogas'.

Meanwhile, bp also used the statement to announce that it is 'scaling back plans for development of new SAF and renewable diesel biofuels projects at its existing sites, pausing planning for two potential projects while continuing to assess three for progression'.

Commenting on the Brazilian acquisition and the 'refocusing' on other international projects, Emma Delaney, bp's executive vice president, customers and products said: 'bp Bunge Bioenergia is widely recognised as a leader in the industry. I am excited by the opportunity for bp to now add further value from our trading and technology capabilities. bp was an early entrant into the bioenergy business in Brazil and we look forward to continuing to grow and develop here.

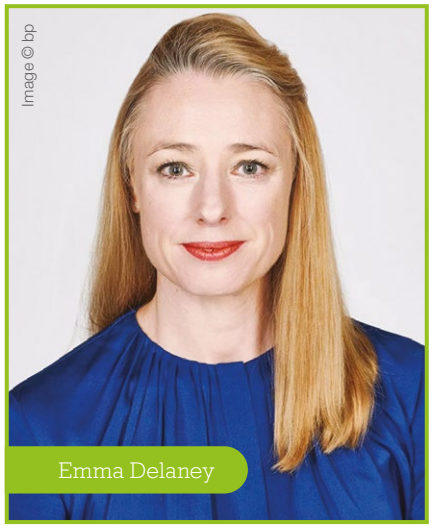
Image © bp

Emma Delaney

'Focusing our plans to develop new biofuels projects is also driven by value. Taken together, these changes can enable us to deliver the growth and returns we expect from biofuels, but in a simpler, more focused way. This is fully in line with bp's priorities of driving focus into the business and growing shareholder returns.'

bp did not specify which projects were being paused or reassessed, but the news agency *Bloomberg* said the company's Cherry Point refinery in the US and Lingen plant in Germany may be two facilities where biofuels production plans are being scaled back.


Image © Shutterstock

Shell has announced that it is to 'temporarily pause' on-site construction work at its 820,000 tonnes a year biofuels facility at the Shell Energy and Chemicals Park Rotterdam in the Netherlands.

In a statement issued at the beginning of July, the energy major said it had taken the decision so as to 'address project delivery and ensure future competitiveness given current market conditions.'

As a result, contractor numbers will reduce on site and activity will slow down, which Shell said would help to 'control costs and optimise project sequencing.'

As previously reported by *Bunkerspot*, Shell confirmed the Final Investment Decision (FID) on the project, which had been scheduled to start production this year, in 2021. The facility will produce low-carbon fuels such as renewable diesel from waste in the form of used cooking oil, waste animal fat and other industrial and agricultural residual products.

'Temporarily pausing on-site construction now will allow us to assess the most commercial way forward for the project,' said Huibert Vigeveno, Shell's Downstream, Renewables and Energy Solutions Director.

'We are committed to our target of achieving net-zero emissions by 2050, with low-carbon fuels as a key part of Shell's strategy to help us and our customers profitably decarbonise,' added Vigeveno. 'And we will continue to use shareholder capital in a measured and disciplined way, delivering more value with less emissions.'


Image © Shell

Huibert Vigeveno

INTERVIEW: Keeping it 'relevant' underpins everything we do, says KPI OceanConnect's CEO

While geopolitical uncertainties continue to interrupt global trade flows – thereby significantly impacting vessel routes – the heat and volatility seen in bunker pricing some 12-18 months ago has certainly moderated. As such, traders and physical suppliers are no longer enjoying the bumper revenues and profits they reaped over a year ago. Talking to *Bunkerspot* on the publication of its FY 2023/2024 results, KPI OceanConnect's CEO Anders Grønborg reviews the company's fortunes, successes and challenges in the past year in the context of a 'calmer' market and he explains how it is positioning itself to be ahead of the curve in a commercial environment which is being increasingly driven by the imperative of decarbonisation.

In autumn 2022, Anders Grønborg moved from his role as Global Head of Sales at Bunker Holding to become CEO of bunker trader KPI OceanConnect. In the first year of his tenure, as a result of a shift in the geopolitical order and subsequent concerns over global energy supply security, bunker prices spiked, and KPI OceanConnect saw a 50% hike in volumes, a doubling of revenue to $5.87 billion and earnings before tax of $49 million.

The company's financial performance in FY 23/24 is not quite so stellar but it is reflective of a calmer market. Pre-tax profits fell 59% year-on-year to $20 million and revenue drifted back from the previous year to settle at $5.6 billion. However, the company has managed to maintain and build on the volume upswing achieved in FY 22/23. Annual volumes have grown by some 9% on the year and, as Anders Grønborg outlines, they are now 'well north of one million tonnes a month, which was one of the big milestones that I set for the group in the financial year.'

> 'We are demand aggregators at the end of the day, so the agreements that we have in place right now are super important to us'

KPI OceanConnect's Global Accounts team, which handles the company's large clients and contracts, as well as its back-to-back team, which is more oriented towards spot purchases, have each played their part in pushing up volume. Jesper Sørensen, who was appointed to lead the alternative fuels and carbon markets team in September last year, has also contributed to a sustained uplift in volumes.

Looking back on the outcomes of the past year, Grønborg says: 'We set out a very ambitious target for the group and we have pretty much delivered on all the different parameters and points.

'It's a big testimony to the whole team that we have come with some financially very strong results, but we have also delivered on one big pillar for us, which was to grow our market share.'

Speaking to *Bunkerspot* in July last year, Grønborg was already seeing signs of a more settled market in prospect. A year on, this trend has continued to play out.

'There will always be challenges when you have markets like we have now,' he reflects. 'The market is fairly flat right now and it has an effect on your financial performance – we are very well aware of that.'

Fears that the shipping industry was heading for a credit squeeze have, thus far, proved to be unfounded.

'Looking around at the major shipping segments, they are all doing fairly well,' says Grønborg. 'Tankers are still flying, containers are not doing too badly, and for dry bulk, most of our clients are saying it's doing fairly well.'

In terms of the 'health' of the bunker market, Grønborg notes that: 'We are seeing our clients deploying more ships and on longer voyages because of what we are seeing in parts of the world, so a push of demand I guess ▶

is the word here.'

As a company, KPI OceanConnect has seen some organisational 'rejigging' over the past year, including the appointment of new regional leads. 'We needed a change in leadership and a focus on the different regions,' says Grønborg, noting that the new regional leadership structure supports and aligns with his management direction as CEO and that of his executive management team, COO Dorthe Bendtsen and CFO Victoria Freeman.

Creating a regional leadership framework 'has given a lot more focus on the business and on ESG,' he comments.

Grønborg came into KPI OceanConnect with a determination to be people focused. Almost two years on, he points to the success of its 50for50 programme, which donates $50 for each bunker order confirmed during November and December and which raised $123,000 last year, as well as its 'get fuelled' training programme which offers trainees the possibility to get a degree and graduate from the Danish Shipping Academy.

Its latest cohort of graduates are now ready to 'fly', with placements in Middlefart and Rotterdam, and the company has just started the recruitment process for its next programme.

Moving on to environmental regulation, from the start of 2024 shipping is being moved incrementally into the EU's Emissions Trading System (ETS) with owners having to become well versed in the purchase and surrender of emissions allowances (EUAs). As a trader, KPI OceanConnect has to be part of that EU ETS transition journey.

'Some of our customers are very far into the process, with us and with others such as banks,' Grønborg explains.

'We have been getting the onboarding process going at a very early stage, so we are ready when people start buying [EUAs], and we expect the real momentum to start sometime around October.'

Inclusion in the EU ETS takes shipping into a new sphere. Carbon trading is very much a financial transaction, removed from the traditional bunker deal, and has the potential to generate a new revenue stream. However, Grønborg emphasises the seriousness of emissions reporting and compliance with EU ETS obligations.

'If people are going to get adventurous on this, I think they are going to have to be very careful – and we are not one of them, I can tell you.'

Asked how KPI OceanConnect is positioning itself to work with clients on the energy transition, Grønborg says that the process is well underway. From an organisational perspective, the company appointed a number of alternative fuels leads in the past year, under the direction of Jesper Sørensen.

On a supply basis, the company now has more than 100 biofuel locations around the world. In the last year, it has conducted the first biofuel bunkering at the Port of Fujairah, and supported LNG and biofuel bunkering operations and simultaneous operations (SIMOPs) for clients in the cruise, PCTC, bulk and chemical shipping sectors.

In late June, the company was also involved in the bunkering of Yang Ming's containership *YM Together* with B30 HSFO biofuel at the Port of Busan in collaboration with bio-supplier GC Caltex, marking the first supply of biofuel to a foreign-flagged vessel in South Korea.

'We have partnered up with a lot of suppliers – we have done a lot of MoUs,' Grønborg explains.

'This financial year has been a year of many trials, and we have a lot of deliveries to big container lines and to some tanker companies where it's mainly biofuel and LNG, because they are the most common products in the market right now.'

While it's still very early days in the provision of methanol as a marine fuel – and ammonia is even further out on the horizon – Grønborg says the company already has a couple of agreements in place with suppliers so would be in a position to take part in trials if this was required.

He also says that there are clear signs that the company's clients are increasingly gaining clarity on how future fuel choices will align with their own trade routes, while cargo owners are also asking more questions about ship owners' plans for the energy transition.

Looking along the fuel supply chain, Grønborg highlights KPI OceanConnect's key roles as an advisor to clients and a partner to suppliers.

'We are demand aggregators at the end of the day,' he says, 'so the agreements that we have in place right now are super important to us.'

Harnessing the potential of digitalisation was also on Grønborg's to-do list when he joined the company and he highlights how it is supporting the ongoing development of its online

auction platform for bunker procurement, AuctionConnect. In the last financial year, some new large clients have been onboarded, he says, while the platform's offering has been broadened and further refined. Around $1 billion of business went through the platform in FY 23/24, in line with the previous year's tally. However, Grønborg reminds that bunker prices have come off the boil in the last financial year and there has been a 5-7% increase in volumes going through the platform.

The online bunker pricing and data tool BunkerEx has also been absorbed into the KPI OceanConnect parent group's portfolio in the last financial year, and this has opened up 'a whole new universe of clients from outside the traditional shipping segments,' says Grønborg.

'The digital journey for KPI OceanConnect, for myself, and for the whole group is still the same,' he explains.

'It is very important for us because a lot of our clients are looking for simplicity, for transparency; they want to be able to audit everything that they do.'

Looking to the future, Grønborg focuses on the word 'relevant'.

'We want to stay relevant for our clients, [in terms of] conventional fuels, the alternative fuels, EU ETS, and derivatives trading as well. If we have all these things in our toolbox, then it becomes very relevant to many of our big clients.'

From Grønborg's perspective, KPI OceanConnect met its financial and market share targets last year, and the current financial year has started well. As for the next wish list, he says the company is looking at a couple of strategic new offices around the world and, potentially, additional senior people could be brought onto the team.

'My job right now is taking what we have got to the next level – thinking where I need to be strategically and where my clients are right now,' he says.

'It's a fine balance between the value proposition, the people, and what surrounds this.' ■

USTC acknowledges its 'annus horribilis'

The impact of events such as a landslide at its Nordic Waste business and large losses sustained by Bunker Holding due to the termination of its cargo activities in Africa resulted in a 91.38% drop in pre-tax profits in FY 23/24 for Denmark's United Shipping & Trading Company (USTC), which is part of the Østergaard family's overall holding company, Selfinvest.

USTC's profit before tax for FY 23/24 totalled DKK 252 million, a dramatic fall from the previous year's record result of DKK 2,926 million.

The group delivered the second-best result in its history with DKK 1,834 million, but reductions of DKK 1,582 million must be applied, resulting from the closure of individual activities. Group revenue dropped from DKK 150 billion to DKK 117 billion.

Four USTC companies – Bunker Holding, CM Biomass, SDK FREJA, and Uni-Tankers – each posted pre-tax profits of more than DKK 200 million from their operations. According to USTC, such a 'concrete result' validates its strategy of having multiple and diverse revenue streams.

Earlier this year, a landslide at the USTC subsidiary, Nordic Waste, which specialised in dealing with contaminated soil, resulted in the Danish Ministry of the Environment issuing interim injunctions against the company. Following the ruling, Nordic Waste filed for bankruptcy.

Early in 2024, Bunker Holding took the decision to shut down its cargo activities in Africa, due to 'political instability, self-sanctioning in relation to the sale of Russian oil, and unfavourable market conditions in the region.' This action is said to have resulted in significant losses in FY 2023/24.

Bunker Holding delivered a profit before tax of DKK 875 million, which was said to be 'broadly distributed across [its] portfolio of trading units and other activities'.

Looking at other USTC subsidiaries, Global Risk Management, in its second financial year under the direct ownership of USTC, achieved a gross profit of DKK 345 million and a result before tax of DKK 152 million.

Uni-Tankers, which operates a fleet of owned and chartered chemical tankers, posted profit after tax of DKK 357 million. This has enabled the repayment all of the company's debt and a near 40% increase in equity to DKK 1.162 billion.

Co-owner and CEO of USTC Nina Østergaard Borris expressed her disappointment in the Group's overall results. 'As CEO, it is not pleasant to read this year's financial statements. It is far below what the Group has achieved in recent years,' she commented

However, she pointed to the business's 'good start' in the new financial year. 'It speaks volumes about the company's culture that we can take some hard hits but keep fighting, and I am very impressed with what our employees have accomplished,' she said.

Co-owner and Chairman of the Board, Torben Østergaard-Nielsen, also offered his reflections on the past year, noting that: 'One disaster rarely comes alone, and the past year has in every way been an "annus horribilis" with the closure of activities we otherwise had high expectations for.

'It has particularly hurt us all that we had to let a company in the Group go bankrupt for the first time in our nearly 150-year history.

'That said, I am proud that we are closing the year with a positive result. Had we avoided these isolated events, USTC would have delivered its second-best result ever. This gives me confidence for the future.'

INTERVIEW: Frank Dahan, Senior Director Strategic Sourcing and Global Fuel Strategy, CSL Group

In 2019, the CSL Group embarked on a new programme aimed at incorporating marine biofuels in its fleet's bunkering plans. Now in its sixth year, the company has eight vessels running on B100 biodiesel. Speaking to *Bunkerspot*, CSL's Senior Director Strategic Sourcing and Global Fuel Strategy, Frank Dahan, says he hopes the company is able to expand its use of biofuels, but warns that without government subsidies and customer buy-in, it may well prove a challenge

Biofuels are becoming an increasingly more established means to shave off carbon emissions in the shipping sector. In 2019, one of their earliest adopters, The CSL Group (CSL), launched a biodiesel pilot project, conducting tests on the auxiliary engine of one of its vessels in a bid prove the fuel's technical viability. Since then, CSL has expanded the programme and since 2022 has eight ships running on B100 biodiesel.

Asked about the background to the project, Frank Dahan, the company's Senior Director for Strategic Sourcing and Global Fuel Strategy, explains that biofuel was a logical choice when it came to reducing its environmental footprint. The company operates self-unloaders meaning that retrofitting tanks for other alternative fuels such as LNG on deck would have been financially and technically challenging. But as Dahan explains, at the time, biodiesel was not recognised as a marine fuel.

'We approached Transport Canada; we approached the US Coast Guard. Would we even be allowed to test this? Also, engine manufacturers would not allow us to burn this inside the engines as it would have voided the warranty, so we had to take vessels that were off warranty.'

After putting a technical team together, the company approached lubricant suppliers and class societies to determine the implications of burning biodiesel before presenting a plan which involved the segregation of systems to Transport Canada and the US Coast Guard.

'We had a separate system for marine gasoil (MGO) and a separate system for biodiesel in the event that if something went wrong, we would be able to still safely go back to MGO on a separate system and run the fuel.'

But while the company's plans were eventually accepted by the authorities, sourcing fuel for the trial would initially prove challenging.

'In 2019 when this started, we started approaching all oil majors. Most of them, their response was, "Frank, are you crazy, this can't be done!" Here we are five years later, and all of them are collaborating and asking how we did it.'

The answer was to build a supply chain. CSL approached a biodiesel supplier that was not in the marine space and explained to them the ins and outs of bunkering – the safety requirements, vessels, drafts, the booms, oil spill response, the constraints of ETAs. Indeed, the company was able to overcome the technical hurdles, but the biggest challenge was, unsurprisingly, the cost of the biodiesel itself.

'The price differential when we started this was huge but, to be extremely fair, it was a theoretical price difference because there was no market for marine biofuel,' says Dahan. 'There was no demand, there was no supply (we created a supply chain) so there was a theoretical huge gap between both [types of marine fuel].'

Asked to put a rough figure on the differential, Dahan estimates this theoretical price difference was 'at least 50% extra premium to MGO'. This has narrowed considerably in the years since CSL began the biofuel programme. However, the main problem today, says Dahan, is the lack of alignment between the Canada and US as well as among the ►

Image © CSL Group

US states themselves.

'I can get biodiesel in Baltimore or New York probably at parity to MGO if I am able to retain my RIN [renewable identification] credits, but if I sail outside of US waters then I lose my RIN credits and then that biodiesel becomes, depending on the region, $250 to $400 premium a time,' says Dahan.

While the additional costs of alternative fuels such as biofuel are expected to be passed on to maritime customers, CSL is yet to take this course of action, instead covering 100% of the expenses. The company is hopeful that it will soon be able to welcome customers that will contribute to programme in the near future. Regardless, Dahan is convinced that taking a leading position is the correct one.

'We've done what we needed to do,' says Dahan. 'We set out to find a fuel that can decarbonise – and I'm not saying that biodiesel is the solution – but what we believe is that the biodiesel solution is going to be part of a portfolio of solutions. Definitely, for us, the solution of choice for existing assets… and that means for us easily another 20-25 years for vessels operating in fresh water.'

Looking ahead, CSL is keen to continue the biofuel programme in 2025 and beyond. However, this, says Dahan, is heavily dependent on outside support, either in the form of government subsidies and/or customer buy-in.

'We will need to review what we do for 2025. It could be a question mark as to what we do depending on what the government does, but that being said, we are still definitely committed to being extremely green and to leading decarbonising initiatives in the Great Lakes and in the industry.'

Dahan points to a 21-year strategic partnership between CSL and BCI Minerals, announced in July, to build and operate a diesel-electric transhipment vessel which will be engineered 'for future conversion to clean fuels or electrification.'

Other decarbonisation initiatives include the application of VentoFoil suction sails for wind-assisted propulsion to a mechanical/pneumatic cement ship under construction for CSL and SMT Shipping's joint venture, Eureka Shipping, as well as its participation in a green shipping corridor project with US ports in the Great Lakes and its involvement with the Australian Port Authorities with shore power initiatives. CSL has also developed its own inhouse artificial intelligence programme: O2.

'What this allows us to do is basically monitor vessels in real time, if we see there's traffic somewhere, we slow [operations] down, save energy, save emissions,' says Dahan. 'This is helping with our GHG reductions.'

According to Dahan, a lack of development on the supply chain front remains the biggest barrier in delivering the shipping sector's decarbonisation transition.

'If I go to the US East Coast – New York for example – New York is going to have to decide what it is going to put in its tanks. Is it going to put VLSFO, MGO, biodiesel, methanol, LNG – there's a limit as to what the shoreside infrastructures are,' says Dahan. 'If New York decides to do MGO and methanol, but then it's possible that Mobile and Houston will decide against methanol and go for LNG and MGO – that's going to impact shipowners' decisions as well.'

He adds: 'I think what needs to happen today is more of these conversations between shipowners and the supply chain because we're making decisions today that are going to last for the next 30 years when we're building these ships.' ■

INTERVIEW: Marie-Caroline Laurent, Director General CLIA in Europe

Having had to weather the storm of the global pandemic, the cruise industry is now working to ensure its preparedness for the energy transition, as well as absorb criticism from some quarters about its environmental footprint. Speaking to *Bunkerspot*, Marie-Caroline Laurent, Director General CLIA in Europe, explains how the sector is responding to these challenges

After a turbulent start to the decade, it would appear that the cruise industry is back on track. Passenger volume in 2023 reached 31.7 million, which marked a 7% increase on 2019. Moreover, 27% of cruisers over the past two years were new-to-cruise, an increase of 12% over the past year.

'This shows that the reality [of] the market is that we still see an increasing number of people being attracted by cruise products as a holiday option,' says Marie-Caroline Laurent, Director General CLIA in Europe. 'It remains one of the most price-competitive holiday options at the moment on the market in tourism.'

While it is showing signs of recovery, the cruise industry still bears the scars of the global pandemic. In its *State of the Cruise Industry Outlook 2021*, published at the end of 2020, CLIA estimated that the suspension of cruise operations between March 2020 and September resulted in a loss of more than $77 billion in global economic activity. According to Laurent, one 'silver lining' of the COVID pandemic was the effect that it had on fleet renewal, expediting the decommissioning of older vessels for new, less carbon-intensive ships. The current average age of a vessel in the global cruise fleet stands at 14 years old – the lowest ever. This, says Laurent, was also done with the energy transition in mind, having already been preparing for the inclusion of shipping in the EU's Emission Trading System – something which, says Laurent, is welcomed by the cruise sector.

'As a cruise industry, we have never opposed the pricing of carbon. This allows us to actually put a price for investments and justify our investments into new technologies.'

There are currently 56 cruise vessels on order for the next five years and many of these will be equipped with alternative fuel propulsion and other energy and emission saving devices. Half of these ships will have LNG engines, a fuel which Laurent says cruise lines invested in LNG 10 years ago, as a 'strong option' in terms of air quality (an important consideration given the amount of time cruise ships spend in port). LNG engines will allow for the transition to sustainable forms of methanol (bio or synthetic).

'For the energy transition, the LNG option has clearly been one of the prevalent choices of our industry so far. In parallel, companies have done quite a lot of biofuel trials in recent years to explore this option. And the final trend we see now with the new vessels ordered is methanol.'

There is an incentive for the cruise sector to ramp up its decarbonisation efforts. While it accounts for less than 1% of the global shipping fleet it is responsible for 2-3% of global shipping emissions. According to Laurent, technologies such a fuel cells will play an important role in cutting emissions in port as they will be able to power the hotel load of the vessel. Another key technology is onshore power supply (OPS). Almost 50% of the global cruise fleet is equipped with shore power capability – and CLIA projects that this figure will rise to nearly 80% by the end of the decade. At the same time, a cruise vessel's shore power capability is only as useful as the number of ports to which it ▶

can connect. According to CLIA, this figure currently stands at 35 in the world. Fifteen of these are in Europe which is far below the 350 ports that are currently used for cruising in the continent. Moreover, EU regulation means that by 2030, cruise ships will be required to connect to OPS.

'We have launched some work internally in CLIA to try to assess a prioritisation of the deployment,' says Laurent, 'because we know there will not be shore power everywhere we go by 2030 [when ship operators will not be penalised for not using shore power if the connection is not available] or 2035 [by which point vessels are advised not to call at ports that do not have OPS facilities].'

Another incentive for cruise lines to accelerate their decarbonisation drive is public perception. The cruise sector regularly comes in for criticism from environmental NGOs over its emissions footprint. In 2022, *Bunkerspot* reported on an article from the International Council on Clean Transportation's Bryan Comer in which he suggested that cruising 'might be worse for the planet' than flying. Meanwhile, some prominent European cruise destinations, including Venice, and Amsterdam, have, or are taking, steps to restrict cruise calls at their cities, citing the environmental impact of cruise ships. As an industry, do cruise lines feel under pressure?

'There are two sorts of concerns voiced,' says Laurent. 'The first one is overtourism and the second one is indeed environmental.'

She continues: 'When it comes to overtourism, definitely we see the cruise [lines] being more targeted as a symbol, but the reality of crowding is unjustified. For Amsterdam, we represent 1% of all the tourist numbers in the city, so it's clearly not the cruise vessels that are creating overcrowding. For Barcelona it's slightly higher, I think we are at 5% of the tourism in Barcelona, and Venice doesn't have cruise ships anymore and still has more than 30 million tourists per year…'

While Laurent 'strongly refutes' allegations that it contributes to overtourism, she concedes that the sector still has progress to make when it comes to its environmental impact, but suggests that the investment in new, less carbon-intensive vessels is indicative of the progress it is making in this respect.

'We are still a ship, we are still a mode of transport, but there is a clear pathway also for us to reach our zero-emission target and a clear commitment that is not just words but actually money on the table,' says Laurent, in reference to the aforementioned order book. 'The order book is now reaching more than €40 billion of direct investment in Europe in terms of new vessels, new technology, so that's also something important for me to put into context.'

And to those who argue that the emissions footprint of the cruise industry is harder to justify than other segments such as bulk shipping, tankers and containers?

'Whether you want to consider tourism activities are unessential and that you can get rid of them, I think that is a discussion you need to have as a society,' says Laurent. 'For us, we strongly feel that we are actually necessary to a lot of people who want to take holidays.'

Turning to the remaining half of the decade, CLIA will be focussing on ensuring it is prepared to meet the requirements of the FuelEU Maritime regulation. Adopted last July, the main objective of the regulation is to increase the demand for and consistent use of renewable and low-carbon fuels and reduce the greenhouse gas emissions from the shipping sector.

'By next year we need 2% of alternative energy usage, so a lot of our work is to focus on what are the volumes we need, where can we find it,' says Laurent. 'This is the study we are working on and we will be releasing the first part of it in September at [the] SMM [trade event] and the final version will be available next year.' ■

Sea Cargo Charter report shows 'high number' of charterers misaligned with new climate targets

While the reporting goal posts have been changed in the Sea Cargo Charter's third annual disclosure report – with signatories now measuring the climate alignment of their chartering activities last year against the IMO's 2023 revised greenhouse emissions ambition and assessments now based on well-to-wake emissions – only two out of thirty-five companies (Navig8 and Stolt Tankers) showed that their activities aligned with the IMO's 'minimum' and 'striving for' emissions reduction targets.

The Sea Cargo Charter is a global framework for measuring and reporting how the activities of charterers and shipowners align with global environmental goals. In the new *Annual Disclosure Report*, 35 companies, accounting for 19.6% by weight of global dry and wet cargo, set out the climate alignment of their chartering activities in 2023 against the IMO's revised ambition which aims for net-zero emissions 'by or around' 2050.

The 2023 IMO GHG Strategy also includes 'minimum' and 'striving' goals for emissions reductions by 2030 and 2040 and, to reflect this, signatories have measured their emissions intensity against both trajectories. The new IMO targets are more ambitious than the organisation's 2018 targets of a 50% reduction in emissions by 2050 compared to a 2008 baseline.

Acknowledging the high number of misalignments with IMO targets in the new survey, the report notes that 'comparing this year's climate alignment scores to last year's scores is irrelevant, as this year's trajectories are based on a much higher ambition and on including the full life cycle emissions.'

It continues: 'While some signatories show alignment with both the minimum and the striving trajectories, it comes as no surprise that a majority of signatories are misaligned with both trajectories.'

For 2023, the average climate alignment scores were 16.9% for the minimum and 21.9% for the striving trajectory, with scores ranging from -16.5% to 47.6% (minimum) and -14.8% to 54.7%.

The report suggests that these ranges 'reflect the diversity of the signatories' operational and trade profiles.'

Signatories also said that they have made 'significant progress' in gathering data from shipowners for the Sea Cargo Charter reporting over the past years. This year's climate alignment scores are based on an average reporting rate of 93.2%.

However, signatories did highlight that their climate alignment scores 'are a clear signal on the progress that still needs to happen in the next years to deliver on these ambitions'.

'Top of the class' in this year's report was Stolt Tankers, with a score of 16.5 % better than the 'minimum' trajectory and 14.8% above the 'striving' trajectory, and Navig8 with a score of 5.19% (above 'minimum') and 0.83% (above 'striving').

In 2022, 14 companies demonstrated that their activities were aligned with the IMO's initial greenhouse strategy.

The Sea Cargo Charter was established in 2020 by a group of cargo owners, Anglo American, Cargill, Dow, Total, Trafigura – and shipowners – Euronav, Norden, Stena Bulk – in collaboration with law firm Stephenson Harwood and support from the Global Maritime Forum, UMAS, and the Smart Freight Centre. In April this year, the Sea Cargo Charter was expanded to include pure shipowners.

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Port of Gdańsk, Poland

Ian Taylor gives an update on the Polish bunker market

When *Bunkerspot* last focused on the Polish bunker market in our June/July 2022 issue, there were two big uncertainties hanging in the air: how would Russia's invasion of Poland's neighbour Ukraine pan out; and the more local matter of whether the European Commission would give the green light to the merger of PKN Orlen and Lotos.

Now, more than two years on, the conflict in Ukraine is continuing, with little sign of resolution. The merger of Poland's two big energy players, however, has gone ahead, and the national gas company Polskie Górnictwo Naftowe i Gazownictwo (PGNiG) is also now part of the Orlen group.

The tie-up between the energy companies means that Poland's two refineries – Orlen's 330,000 barrels a day (b/d) Plock facility and the 210,000 b/d plant Gdańsk formerly belonging to Lotos – are now within the same group. Orlen supplies most fuels in Poland at the wholesale level and also controls much of the retail infrastructure.

In the bunkering sphere, Orlen (and its now-liquidated subsidiary Ship-Service) and Lotos both had considerable presence prior to the merger, so it comes as no surprise that the combined entity is a major player. Indeed, company's communications office told *Bunkerspot* that the latest data from the Ministry of Infrastructure indicate that Orlen supplies nearly half of all marine bunker fuel in Polish ports.

Orlen said that it can make bunker deliveries in all Poland's seaports, with the main markets being Gdańsk, Gdynia, Szczecin, and Świnoujście. The company added that it uses its own bunker fuel tanks and makes deliveries using tanker trucks. The products on offer include DMA 0.10% sulphur marine gasoil (MGO) and RMD80 0.1% ultra low sulphur fuel oil (ULSFO) as well as LNG. Orlen also disclosed that it has 'plans to add eco-friendly alternatives soon'. As one would expect, Orlen's bunker fuels are mainly sourced from the Plock and Gdańsk refineries. However, the sources that those refineries draw upon to obtain their feedstocks have changed – mainly because the ongoing conflict in Ukraine has meant that Russian crude is no longer on the menu.

> 'In 2021, the Port of Gdańsk handled 53.2 million tonnes of cargo. The volumes then jumped to 68.2 million tonnes in 2022 and 81.0 million tonnes in 2023'

The company told us: 'The crisis on European markets caused by Russia's aggression against Ukraine demonstrated the fundamental importance of diversification of supply sources and channels, which the Orlen Group has successfully implemented. As part of its diversification strategy, Orlen has built its import portfolio by relying on crude oil supplies from the North Sea, West Africa, the Mediterranean and also the Persian Gulf and Mexico. Therefore, our marine fuels are produced in domestic refineries without Russian oil.'

This re-alignment comes at price, however, as Russia was traditionally a good source of plentiful oil and, of course, much closer to Poland than Mexico or West Africa.

The conflict in Ukraine has also had on impact on the demand side of the region's bunker markets, as the country has had

Image © Orlen

Loading arms of the fuel terminal on the Martwa Wisła river

to redirect cargo away from its Black Sea ports. This has boosted throughput volumes in Romania's Constanta and Burgas in Bulgaria, as well as the main Polish ports.

The Port of Gdańsk, for example, has seen a significant increase in throughput in recent years – both because of the redirection of Ukrainain throughput cargoes and the need to import goods, commodities and hydrocarbons for its own domestic markets that would previously have come from Russia by rail or road. In 2021, the Port of Gdańsk handled 53.2 million tonnes of cargo. The volumes then jumped to 68.2 million tonnes in 2022 and 81.0 million tonnes in 2023. The growth was most noticecable in liquid fuels, which increased from 13.7 million tonnes in 2020 to 37.6 million tonnes in 2023; and coal, which surged from 4.8 million tonnes to 13.4 million tonnes.

Looking ahead, the Port of Gdańsk expects to see further growth when a new floating LNG terminal comes into operation, with the first commercial shipments set to begin in 2028. When the port authority signed an agreement with Gaz-System for the terminal in May 2024 it said that project would 'contribute to the diversification of the natural gas supply sources to Poland' and also 'secure over 30% of the country's demand'.

In June, the Port of Gdańsk celebrated its progress on another key expansion plan, with a cornerstone-laying ceremony for the construction work on a third deep-water quay which will boost the Baltic Hub terminal's capacity to 4.5 million TEUs a year.

Given the rise in cargo throughput and the planned increase in port infrastructure, Poland's bunker market is likely to grow beyond its current level of around 250,000 metric tonnes a year and the main suppliers said that they are looking to expand their supply infrastructure to meet this extra demand.

'Currently,' we were told, 'the Orlen Group is actively strengthening its position in the marine fuels market by accelerating ongoing investments, such as the construction of a terminal on the Martwa Wisła river. Upon the terminal's completion, the company plans to introduce a bunkering vessel to serve the ports of the Tri-City with traditional fuels and biofuels. The construction is expected to be finished in the second half of next year.'

> 'Poland will continue to play a crucial role as a transportation route to Ukraine, and Polish sea ports will remain essential elements in the regional supply chain'

Another Polish supplier, Unimot, has also been ramping up its bunkering operations. The company is a new entrant to the bunker market: it made its first delivery in March this year in Gdynia and has since expanded its coverage to include Gdańsk, Szczecin, Świnoujście and Police.

The company's press office told us that Unimot is offering truck deliveries of LS MGO:DMA with a maximum sulphur content of 10 parts per million (ppm), adding that it is 'primarily relying on outsourced services' for the trucks although it 'does have the capacity to utilise its own fleet when necessary'. In addition to bunkering seagoing vessels, the company also makes deliveries to inland craft (which can use fuel with a sulphur limit of 20 ppm).

While Unimot said that the 'specific sources of our bunker fuel are proprietary information and cannot be disclosed', it confirmed that two of the nine fuel terminals owned by its sister company Unimot Terminale are used as storage and distribution hubs for its bunker operations. The two terminals are located in Gdańsk and Szczecin, for easy access to the main bunker markets.

Looking ahead, Unimot indicated that it may start making bunker deliveries by barge and extend its product range beyond MGO, telling us: 'We are working on a possible expansion of our activities in the deliveries of residual

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bunker fuels (VLSFO and HSFO) and typical DMA grade with 0.890 density and 0.10% sulphur carried out by bunker vessels in the port of Gdańsk and Gdynia as part of the planned expansion of the terminal infrastructure in Gdańsk. This will be a part of a joint project with Peninsula Petroleum Limited. Both companies have signed a letter of intent regarding the cooperation in the area of supply of marine fuels in the ports of Gdańsk and Gdynia.'

While Unimot is new on the block, Oktan Energy has been active in the bunker market since 1997, using its own fleet of barges and trucks to supply MGO which it imports from the Amsterdam-Rotterdam-Antwerp (ARA) region.

The company owns a 105,000 cubic metre (cbm) tank farm in Szczecin which has eight road tanker loading stations as well as a quay for the transshipment of petroleum products and a railroad track with petroleum handling stations. It also co-owns other tanks in Szczecin and Świnoujście with a total capacity of 160,000 cbm. Oktan Energy told *Bunkerspot* that it currently has a 50% share of the Polish market for MGO DMA and 10 ppm products, and it supplies both in-port and off-shore with most of the business being conducted on a spot basis.

Oktan Energy's supply infrastructure includes: 38 road tankers, each with capacity for 25 mt; five 450-mt capacity bunker barges, located at Szczecin, Kołobrzeg, Władysławowo and Gdańsk; three sea-going vessels (the 5,885 mt *Oktan*, 3,550 mt *Straitview* and 2,490 mt *Angon*); and four tankers located in Szczecin (the 3,001 mt *Neptunus*, the 2,198 mt *Argonaut*, the 2,166 mt *Internautic* and the 1,223 mt *Janinaa*) as well as two in Gdańsk (the 1,200 mt *Inka* and 3,300 mt *Pola*).

In addition to its bunkering activities, Oktan Energy is one of the biggest importers of fuels in Poland and a major player in terms of the production, storage and sales of diesel oil, heating oil and MGO.

Even the most seasoned political analysts seem uncertain of when or how the Ukraine war will end. There are so many factors and so many actors. We have seen the conflict used as a political football in the tussle between Russia, the United States – and now China appears to be getting more involved too, by deploying troops in Belarus for 'anti-terrorism training'. For now at least, Unimot seems to have the measure of the conflict's impact on the Polish bunker market when it says that: 'Poland will continue to play a crucial role as a transportation route to Ukraine, and Polish sea ports will remain essential elements in the regional supply chain.' Furthermore, Orlen pointed out that: 'At the turn of the year, the transition period for the EU ban on LPG imports from Russia will end. Whether it is LPG imports or other products supplied by fuel streams from the eastern direction, maritime routes play a major role in subsidising and thus balancing the market. This potentially will be another factor contributing to further growth in port traffic.'

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Going to plan?

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The recent round of European elections changed the political complexion in some key member states, but will these results put a brake on the decarbonisation of shipping? **Mark Watts** of LP Brussels offers his perspectives

The European elections this year were characterised by an unusually heated and polarised campaign with a high stakes outcome. Would the far-right win and end the post war political consensus in Europe, throwing into doubt symbolic policies like the Green Deal? The headlines screamed out 'far right surge' and the results led to the fall of the government in France, and much heart searching elsewhere, particularly in Germany.

During the campaign many of the policies and regulations adopted in the EU in the past five years, such as the Green Deal and

Fit for 55 Package, including those new regulations for shipping, were questioned. So, when we look behind the headlines, what does it all mean for the next five years for the regulation of the shipping industry and alternative fuels?

Counterintuitively perhaps I think it means a period of stability and certainty, as the focus will shift to the implementation of the complex regulations agreed in the past five years to decarbonise shipping, rather than a roll back of regulations, or new regulations. It will also focus on finding ways of helping European industries not just make the transition but also drive the global energy transition. In particular, the next mandate will witness the implementation and consolidation of three major changes to the regulatory and financial framework for shipping, namely the full implementation of the extension of the EU's Emissions Trading System (ETS) to shipping, which has already begun, the Alternative Fuel Infrastructure Regulation (AFIR) and, above all, the FuelEU Maritime (FEUM) Regulation, which mandates cuts in greenhouse gas (GHG) intensity from next year.

Why do I say that? First, the results were not as black and white as the headlines suggested. The far right did well in certain member states, most notably France and Germany, but less well elsewhere. So overall, the so-called 'super grand coalition' that has run Europe for several decades, an informal alliance between the Christian democrats, the social democrats, and the liberals, held its ground. They had 60% of the seats in the last European Parliament before the elections, and they are not much short of that now.

A key priority of the last mandate was for Europe to become the first climate neutral continent in the world by 2050. The illegal Russian invasion of Ukraine has strengthened that objective, because of the strong desire for energy security and less reliance on imported fossil fuels. And whilst the talk during the campaign, and in the past few weeks in Brussels, has all been about making competitiveness the number one priority, the reality is that green policies, except for some related to farming and a review of the 2035 ban on petrol and diesel cars, will not be weakened in this new term.

Indeed, Ursula von der Leyen vowed, before her re-election as European Commission President, to not weaken Europe's efforts to tackle climate change if she won a second five-year term, the EU's most powerful body. '*We must and will stay the course on the goals set out in the European Green Deal.*' The next EU Commission, led by her, will therefore continue with the EU's existing CO_2-cutting policies, the change will be she'll also propose new additional measures to help European industries stay competitive while they invest in curbing emissions – a 'clean industrial deal' that von der Leyen pledged to deliver within her first 100 days in office.

So now energy security, decarbonisation and European industrial competitiveness are seen as the three key pillars of EU policy. Her re-election by the European Parliament, with an increased majority, is particularly significant bearing in mind the headlines I referred to above, clear evidence that the 'super grand coalition' will continue to dominate the EU for at least another five years, and measures like FEUM will be implemented. So whilst some in the shipping industry were planning to wait this one out, it is now certain international shipping calling at EU ports will have to decarbonise, or they will face heavy penalties, that will in time significantly exceed the cost of the energy transition.

> 'Shipping and energy sectors have been making the case for more support, but for an industry that has for decades deliberately sought to stay off the regulator's radar, it is little understood and not much loved'

Will the maritime and energy sectors be part of that clean industrial deal and also secure support in terms of reducing the cost burden of transition and strengthening international competitiveness? A key test will be whether shipping decarbonisation secures its fair share of the EU's Innovation Fund and other funding and investment initiatives which will form part of a new Industrial Decarbonisation Accelerator Act. The Innovation Fund's primary objective is to introduce market solutions that will support the decarbonisation of European industry, while simultaneously enhancing its competitiveness, with funding sourced from the EU's ETS. At least €20 million of ETS allowances, which correspond to around €2 billion under the current ETS carbon price, will already be allocated to maritime projects under the Innovation Fund. But to put this in perspective, the Innovation Fund is worth €40 billion, and even that is a relatively small amount compared to the annual cost of decarbonisation to European society and industry. According to the European Commission's own figures, energy investments in the EU will have to reach €396 billion per year from 2021 to 2030 and €520-575 billion per year in the subsequent decades until 2050 to finance the transition.

Shipping and energy sectors have been making the case for more support, but for an industry that has for decades deliberately sought to stay off the regulator's radar, it is little understood and not much loved. I've heard some industry representatives in Brussels demanding subsidies. That's an instant red flag and ammunition for the industry's many critics. What the industry needs is a mechanism to invest in the energy transition to do its bit to save the planet by preventing catastrophic climate change. And that should be funded from the ETS and FuelEU Maritime receipts that the industry will be contributing too. In other words, not '*can we have a subsidy*', but '*can we have some our money back*.'

Industry also needs to continue to highlight its strategic significance for Europe's competitiveness, trade and security. It was understood during the global pandemic, but this has all but been forgotten. It needs to engage with old and the many new regulators in Brussels, and explain where we need more support, where we need a reduced regulatory burden and where we need greater international regulatory alignment.

In conclusion, the next five or ten years will witness a period of unprecedented change, but at least we now know what change is required. First movers who invest in alternative fuels will seize advantages, including a huge competitive advantage and genuinely doing their bit to tackle climate change. The regulations are broadly technology neutral, so all alternative fuels will be required. I've made the point before that we need them all, and there still will not be enough. That's why we all need to work together to promote the energy transition, push for the scaling up of the production of alternatives fuels, and secure adequate funding to facilitate that transition. Waiting is not a plan.

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Reaction time?

Steve Simms urges bunker traders and suppliers to take notice, as nuclear power has now arrived in their industry

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I'd like to share some 'news' that I think might provoke some interesting reactions (and I'll disclose the details of the source and the time frame later).

The world's first nuclear powered cargo vessel has just finished sea trials. Despite years of fears raised about nuclear contamination or even explosion, the ship has run flawlessly. It emits no carbon, sulphur or other pollutants. Underway, it is faster than just about any other cargo vessel. It can circle the world 14 times at 20 knots (its top speed is 23 knots) before any refueling.

Some ports nevertheless have refused it, despite the fact that the flag state has given them long-advanced information about the extraordinary safety measures designed into the vessel and its nuclear reactor. The flag state also has assured that the vessel's crew are thoroughly qualified in running the reactor and the vessel to the highest standards. The flag state has even enacted law which extends $500 million of protection against damage that the vessel – and its reactor – might cause: essentially the largest marine insurance policy ever.

But this hasn't been achieved without concerns, even among some of the flag state's maritime officials.

Speaking at a national lawyers' conference, the General Counsel of the state's lead maritime agency comments: 'The application of atomic power to the propulsion of ships has created a unique and challenging series of legal and economic issues. Existing legal principles do not supply all the answers. The field is unique in that it is not an area in which the customary development of case law can be permitted gradually to follow the development of technical progress. Instead, due to the special nature of the risks involved, the use by private industry of this great source of power for shipping will be impeded, if not prevented, until the broad legal principles governing responsibility for nuclear damage are established and made uniform among at least the major maritime nations. The welcome of nuclear vessels in foreign ports will be facilitated by agreement on these principles.'

Despite the concerns, well-funded research predicts that in no more than 25 years, there will be at least 65 naval and civilian nuclear vessels operating. According to the research, any shipyard which can build and equip hydrocarbon or similar fueled cargo vessels can build and equip nuclear powered ones. Freight and other port operations will not need to be different for nuclear-powered cargo vessels, than they are for 'standard'-powered ones. While there would need to be port facilities built to refuel nuclear powered vessels, there would need to be far fewer facilities for refueling than for 'conventional' fuels – given that nuclear powered vessels may go for years without refueling. Researchers also concluded that nuclear-powered ships present little or no nuclear hazards; the small reactors used aboard the ships use uranium enriched to a much lower level than weapons grade.

The overall research conclusion is that: 'Assuming a high quality of regulatory control, there appears to be no reason why the construction, initial fueling, start-up, in-port navigation, and routine servicing of nuclear vessels cannot readily be performed with due assurance of the public health and safety in any harbour… physically capable of handling these functions.'

Now, I'd like to bring you up to date. The world's first nuclear powered cargo vessel has been around much longer than you might think. The *NS Savannah* (www.ns-savannah.com) was launched in 1959, made her maiden voyage in 1962 and then operated on a net-zero basis – with no carbon, sulphur or other (including nuclear radiation) emissions – for a decade before berthing up in Baltimore in 1971.

> 'The *NS Savannah* was never intended to be profitable. The U.S.' goal (worth a sizeable investment in 1959) was to show that nuclear power had peaceful uses'

NS Savannah at Pier 13 in Baltimore, 2012

Perhaps ironically, the *NS Savannah* was named in honour of the *SS Savannah*, another trailblazer which, in 1819, became the first steamship (although then mainly under sail power) to cross the Atlantic, from the U.S. to England. The fuel cost of steam power was significant, the power plant and fuel occupied too much vessel space and the public was apprehensive about the new technology. The *SS Savannah's* owners ran into financial difficulties, removed the steam engine, and there was not a U.S. to England steam-powered crossing of the Atlantic for the next 30 years (or from England to the U.S. for about 17 years, as England embraced the technology).

The nuclear-powered *NS Savannah* had an impressive safety record, unsurpassed fuel economy and its white-painted superstructure never had a smudge of exhaust smoke. The ship is now a floating museum (and continuing its history with no carbon or other emissions), with its nuclear core long safely removed.

The quote from the General Counsel above dates from 1961, from the chief legal officer of what became the U.S. Federal Maritime Commission – the U.S. agency which ran (and funded) the *NS Savannah* until de-commissioning. The U.S. 'insurance' against nuclear accident, called the Price-Anderson Act, was extended to the *NS Savannah*, but it was specifically noted that it would not set precedent for later nuclear merchant ships.

Chapter VIII of the International Convention for the Safety of Life at Sea (SOLAS) remains the major international convention governing safety of operation of nuclear-powered cargo vessels. In November 1981, the International Maritime Organization (IMO) adopted The Code of Safety for Nuclear Merchant Ships (resolution A.491(XII) as a Supplement to SOLAS Chapter VIII. Just a few months ago, in May 2024, IMO's Maritime Safety Committee received a major analysis of how that Code could be revised to bring it up to date, led by the industry group World Nuclear Transport Institute (WNTI). Meanwhile, the first comprehensive national governance on nuclear-powered merchant ships – the UK's Merchant

Shipping (Nuclear Ships) Regulations and Marine Guidance Note on nuclear ships, MGN 679 (M) – came into force in late 2022.

There still are more legal developments needed to support the adoption of nuclear power in commercial shipping. But, over the 75 years since the development and operation of the *NS Savannah* and hundreds of other (most all military) nuclear-powered vessels, there has been much thought and planning for the legal – and especially safety – related regulation of nuclear power for commercial vessels.

As the WNTI emphasised recently to the IMO, nuclear reactor technology suitable for ship propulsion has greatly evolved since the Nuclear Code was adopted in 1981. But in its current form, it is prescriptive: specifying the technology and directing what should be done rather than being technology-neutral and goal-based, describing what standards need to be met in a more general way. So, the developing regulation should not prevent new and improved reactor technology, while ensuring that the exemplary safety record of nuclear-powered ships is maintained.

Public concerns about a ship causing a nuclear disaster are unproven. The *NS Savannah* operated for 10 years with nothing even approaching disaster. The U.S. and other navies' almost entirely safe operation for more than 50 years of nuclear-propelled vessels (and the safe operation of the handful other nuclear-powered vessels over the last 50 plus years) shows that nuclear power for ocean vessels can be, and is, safe, efficient, and very environmentally sound.

Yet the sole currently active nuclear-powered merchant ship in the world remains the 1988 Russian-built lighter aboard ship (LASH) vessel, *NS Sevmorput* – still operating safely and reportedly only needing to be refueled twice in 27 years. Along with the *NS Sevmorput*, though, there are presently about 200 safely-operating nuclear reactors aboard about 160 naval ships, submarines and similar military or government vessels.

So, there has been progress on both the law and regulation governing nuclear power for commercial vessels. Meanwhile, the technology has also been moving forward, with a number of emerging small reactor solutions now offering further improved safety and performance.

The holdback has been economic. But now the relatively recent legal changes of the European Union's Fit for 55, FuelEU Maritime (FEUM) and IMO decarbonisation initiatives are leveling this final holdback.

The video of the *NS Savannah's* 1959 christening – https://youtu.be/3hBQUisqNQI?t=71 – is worth a watch. It includes the quote that because the vessel was 'built at a cost of $41 million, she will be uneconomic commercially'.

The well-funded research from 1961 predicting that there would be nuclear-powered commercial ships in operation within 25 years is not close to being met even now in 2024. But the 'uneconomic' tag for the *NS Savannah* wasn't because of its infrastructure or building costs; it was based on the low immediate cost of hydrocarbon fuel (with which nuclear technology had to compete).

Bunker fuel (which was then very high sulphur) cost about $20/MT when the *NS Savannah* went out of service in 1972. Then, a vessel with a 20,000 HP engine using 1970s technology would have burned about 120 tonnes per day for a daily fuel cost of about $2,400. However, following the Arab Oil Embargo in 1974 (which also gave rise to the bunker trading industry) bunker costs rose to about $80 a MT – which would have changed the economics significantly.

> 'FuelEU Maritime doesn't list nuclear power as a zero-emission technology – but the technology is clearly the ''elephant in the room'''

A parallel is the uptake of gasoline for automobiles. At the beginning of the 20th century, gasoline had been expensive and rare, and electric automobiles were relatively common. But then advances in petroleum refining made for cheaper fuel, which supported the automobile makers switching from batteries to the internal combustion engines. Meanwhile, shipping transitioned from coal to oil.

The more environmentally friendly electric automobile engine would have to wait decades to be re-discovered, sparked by both higher petroleum prices and environmental regulation; and shipping is also going through its own transition away from fossil fuel.

Importantly, the cost analysis for the *NS Savannah* didn't include the 'externalities' of using the hydrocarbons. The buyers paid some cost, but those consuming the results were to pay the rest in environmental and health damage. In the theory of legal economics, it is application of law that should redistribute the costs from those experiencing the external effects of a technology, to those benefiting from the technology. So, for example in the U.S. legal system, someone downstream of a polluting factory saving money by polluting (instead of avoiding that) and causing cancer, may recover damages from the factory. The factory can avoid paying damages by investing in technology and expertise, and stay in business by still producing competitively.

The *NS Savannah* was never intended to be profitable. The U.S.' goal (worth a sizeable investment in 1959) was to show that nuclear power had peaceful uses. That became more accepted so that by 1972 the public relations investment for the *NS Savannah* no longer matched operating costs relative to similar 'conventional' vessels. However, had the *NS Savannah* continued to operate just two years more (and figuring a standard bunkered vessel operating 330 days per year), 1974's increase to $80 per tonne for bunkers, given that the *NS Savannah* required no refueling, would have eliminated the difference between the *NS Savannah's* operating costs and that of a similar sized, hydrocarbon-powered cargo vessel.

FuelEU Maritime (FEUM) doesn't list nuclear power as a zero-emission technology – but the technology is clearly the 'elephant in the room'. With carbon indexing and associated vessel emissions reporting and the EU Emissions Trading System (ETS) – the goal of FEUM is to financially incent increasingly lower emissions and raise overall costs for use of hydrocarbons.

FEUM, and its carbon indexing and reporting based on fleet-wide reporting, makes including even a single nuclear-powered vessel in a fleet economically attractive. It is leveling the externalities that hydrocarbon fuels had imposed before – putting the overall cost back to the initial consumer.

CORE POWER, an industry leader in developing nuclear power for commercial vessels, has presented recent analysis showing that, with FEUM's requirements from now to 2050 for decreased emissions, if an owner with a 12 vessel pooled fleet in 2030-2034 replaces a single very low sulphur fuel oil (VLSFO) fueled container ship with a nuclear-electric equivalent vessel, the owner would save about $381 million in FEUM penalties, $70 million in EU ETS costs and $218 million in fuel costs (total savings with the single vessel added to the pool, $669 million). A similar recent study concludes a nuclear ship would be $40 million per year cheaper to operate with bunkers at $500 per tonne. Currently, bunker fuel is about $580-640 per tonne.

The latest designs of Small Modular Reactors (SMRs) haven't yet been installed on commercial vessels, but once manufacturing and installation begins,

estimated SMR prices range from an optimistically low $50 million to over $1 billion.

A note of caution comes from the U.S., where, at the end of 2023, a company called NuScale, which had the SMR furthest along the necessary U.S. Nuclear Regulatory Commission (NRC) approval process, stopped its first, land-based SMR installation when initial cost reached $9 billion. A further caution is that a number of SMR non-light water designs require high-assay low enriched uranium fuel (HALEU). This is fuel enriched in the isotope uranium-235 between 5% and 19.99%. Above 20% is classified as 'highly enriched uranium', which is used by some reactors, while enrichment above 90% is considered weapons-grade uranium. Concerns have been raised that HALEU near 20% enrichment can be more readily enriched further to produce nuclear weapons. There is no current HALEU production outside of Russia. Investment in HALEU production depends on the development of SMRs to support it.

Russia and China now are the only countries with working SMRs. The price of their development isn't – outside of their governments – known. But they do work.

Alongside this we have the IMO's revised Greenhouse Gas (GHG) Strategy – adopted in July 2023 at the 80th meeting of the Marine Environment Protection Committee (MEPC 80) – projecting net-zero GHG international shipping emissions by about 2050, and checkpoints toward net-zero GHG emissions for 2030 (by at least 20% to 30%) and 2040 (by at least 70% to 80%). In the first part of 2024, MEPC 81 drafted an outline for taxing CO_2 emissions from international shipping. The soon-to-be IMO Secretary General Arsenio Dominguez then told the *New York Times*: 'I'm very confident that there is going to be an economic pricing mechanism by this time next year… What form it is going to have and what the name is going to be, I don't know.'

Maersk and the world's largest bunker trader, Bunker Holding, since 2021 and 2023 respectively have advocated for some taxing of hydrocarbon-based fuels (and a pricing model for 'green' fuels). Their efforts have been augmented by a World Shipping Council working group which, in addition to Maersk, includes representatives from other major marine fuel consumers, MSC, CMA CGM, Hapag-Lloyd, Cosco, and Wallenius Wilhelmsen.

With FEUM and the IMO's strategy comes an increasingly common question: what is the 'Well to Wake' (WtW) cost of a 'green' fuel? That is, when consumed as fuel it may produce almost no emissions, but what are the total emissions involved in producing the fuel? Production frequently involves high electricity requirements – generated by fossil fuels. Or, it might involve cutting CO_2-reducing forests to produce biomass with the result of a net WtW CO_2 increase. Costs are involved too in certifying the 'green' bona fides of each element necessary to produce a biofuel – and biofuel prices are driven up by land-based demands for them.

The result of all of this has been a growing interest in alternative fuels over the past 20 years that would have been almost unimaginable before their uptake. It is this economic impact of law and regulation that will prompt the uptake of nuclear-powered commercial vessels.

The market's quick embrace of alternative marine fuels has paralleled the IMO's progressive restriction of fuel sulphur emissions content. A global cap of 4.50% sulphur mass-by-mass (m/m) was introduced in 2005. This was tightened to 3.50% m/m in 2012, and then 0.50% m/m in 2020. Meanwhile, the limit within the Emission Control Areas (ECAs) was lowered from 1.50% m/m to 1.00% m/m in 2010 and then 0.10% m/m in 2015.

Prior to the tightening of these sulphur limits, LNG-power for cargo vessels (other than LNG carriers) was considered an economically unattainable technology. U.S. regional carrier TOTE (which has much carriage in ECAs) then innovated the first LNG-powered cargo vessel followed in 2017 by CMA CGM and other large container carriers. LNG now is a common (although frequently referred to as 'transitional') marine fuel supported by many significant investments in LNG barges and storage locations. The same is true for methanol, and ammonia – both of which had been the focus of safety concerns as well as basic technology for construction of efficient engines to consume them. Even with hydrocarbon-based fuels, the market has responded much more quickly than expected. In the run-up to the 2020 0.50% global sulphur cap there was much worry in the market about the availability and price of compliant fuel. In the event, prices spiked initially but the market responded relatively quickly with adequate production and supply.

Some bunker industry statistician should develop what could be the most telling index (alongside the actual increasing numbers of vessels each year burning alternative fuels): a 'Conference Speaker Index'. That is because before 2013 no regular confer-

Image © Shutterstock

Aerial view of *NS Savannah* at the Port of Baltimore, Maryland, U.S.A.

ence could be found focusing solely on LNG as a marine fuel. Now, hardly any marine fuel conference worth its bunkers doesn't include a number of LNG presentations (including on how to make it more 'green').

The same is true for proliferating conferences specifically devoted to particular 'alternative' fuels. Even three years ago, there would have been none focusing on ammonia, or methanol. At best there might have been a lone speaker on those subjects at a general marine fuel conference, who would be assigned a slot late in the afternoon, when many of the delegates would have transferred their participation to the hotel bar. But how times have changed. In June this year, 250 people attended CORE POWER's Fifth Nuclear for Marine Summit in London and we suspect that the conference circuitry will be going even more nuclear in 2025.

Design is another cost-saving aspect of nuclear-powered vessels. At the end of 2023, Chinese state-owned China State Shipbuilding Corporation (CSSC) through its Jiangnan Shipyard presented a design for the 24,000 TEU, nuclear-powered container vessel KUN-24AP. CSSL reports that maritime classification society DNV gave the design its Approval in Principle (AiP) – DNV's independent assessment of a concept or design confirming both feasibility and that there are no significant obstacles to prevent it from being realised.

The KUN-24AP design proposes a molten salt reactor utilising thorium, a radioactive metal abundant in China. The proposed reactor is designed to operate at low pressure and elevated temperatures. The molten salt reactor would enable the vessel to operate with no engines or driveshafts, leaving ample space for electric motors and even azimuth pods instead of rudders. Auxiliary generators would not be necessary for bow thrusters. The superstructure of the KUN-24AP is bow-mounted and bow axe-shaped, a streamlined design that without a bulbous bow provides for fast sailing – perhaps able to reach the top speed of a nuclear-powered aircraft carrier, 30 knots (56 kph), double the speed of container vessels now in service. The relatively unlimited fuel supply would make slow steaming unnecessary, thereby reducing cargo delivery time by as much as 50%.

The KUN-24AP is not in production. No owners have emerged publicly to fund its building nor has CSSC announced any estimated building cost. But CSSC maintains that the thorium molten salt reactor for the vessel is tested and ready. The vessel design and performance benefits that nuclear power might provide are further costs incentives for its uptake.

So with technology improving, and the press for zero emissions focused on 2050, and law and regulation raising the costs, nuclear power for commercial cargo vessels may be closer than the maritime industry, and bunkering industry within it, now believes.

A further enhancement may be the emphasis on, and development of, green shipping corridors. Nuclear-powered vessels could be deployed for particular green corridors. National legislation allowing for them to be focused between the limited number of ports in the corridor, making a more complex international agreement scheme for nuclear vessel power not immediately necessary.

The carbon tax or pricing mechanism that the IMO will enact in some form over the next years could also fund further development of commercial vessel nuclear power. Crew and support personnel training will be vital in the switch to all alternative fuels and technologies, and funding from the proposed pricing mechanism could include training of the highly qualified nuclear engineers required to work with vessel reactors.

How then should bunker traders and brokers view the development of nuclear commercial vessel power? First, they have to accept that it's coming. Second, it will (perhaps much sooner than previously imagined) be part of the makeup of at least larger vessel fleets, just as those fleet owners now are including ammonia, LNG, methanol, and dual-fueled powered vessels among their fleet's aging 'conventionally-bunkered' vessels. It will only take one large fleet owner or operator – like CMA CGM did with LNG, or Eastern Pacific is doing with ammonia – to invest in an SMR-powered vessel to open the way for many more nuclear-powered vessel newbuildings.

'It will only take one large fleet owner or operator – like CMA CGM did with LNG, or Eastern Pacific is doing with ammonia – to invest in an SMR-powered vessel to open the way for many more nuclear-powered vessel newbuildings'

Among the ideas for SMRs is one that proposes that the enterprises developing and building the SMRs would also own, maintain and lease them – much like is done with many commercial aviation jet engines except with a further element (literally) being that the companies would also fuel the SMRs. Lease rates for a vessel-installed SMR would be based on energy output. SMR leasing (and control) following this approach also might be more palatable to national governments worried by public concerns about nuclear proliferation or accidents. SMRs aboard vessels could, potentially, be more closely regulated.

Bunker traders and suppliers could – just as some are offering carbon credits and related management as part of their offerings – invest in SMR providers and offer their customers SMR leasing as part of an overall fleet fueling and management approach.

Billions of dollars are now being spent on what seem to be more 'certain' technologies like hydrogen power, biofuels – but could nuclear technology be the elephant that steals a march on all of them, with commercialised nuclear vessel power arriving much sooner than anyone previously expected? In the meantime, I urge you to stay in the room when the nuclear speaker is on the conference podium, follow the developments at IMO closely – and visit the *NS Savannah* in Baltimore!

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The opinions and recommendations of this article are his and not necessarily also those of IBIA or SEA/LNG, except if identified specifically as such.

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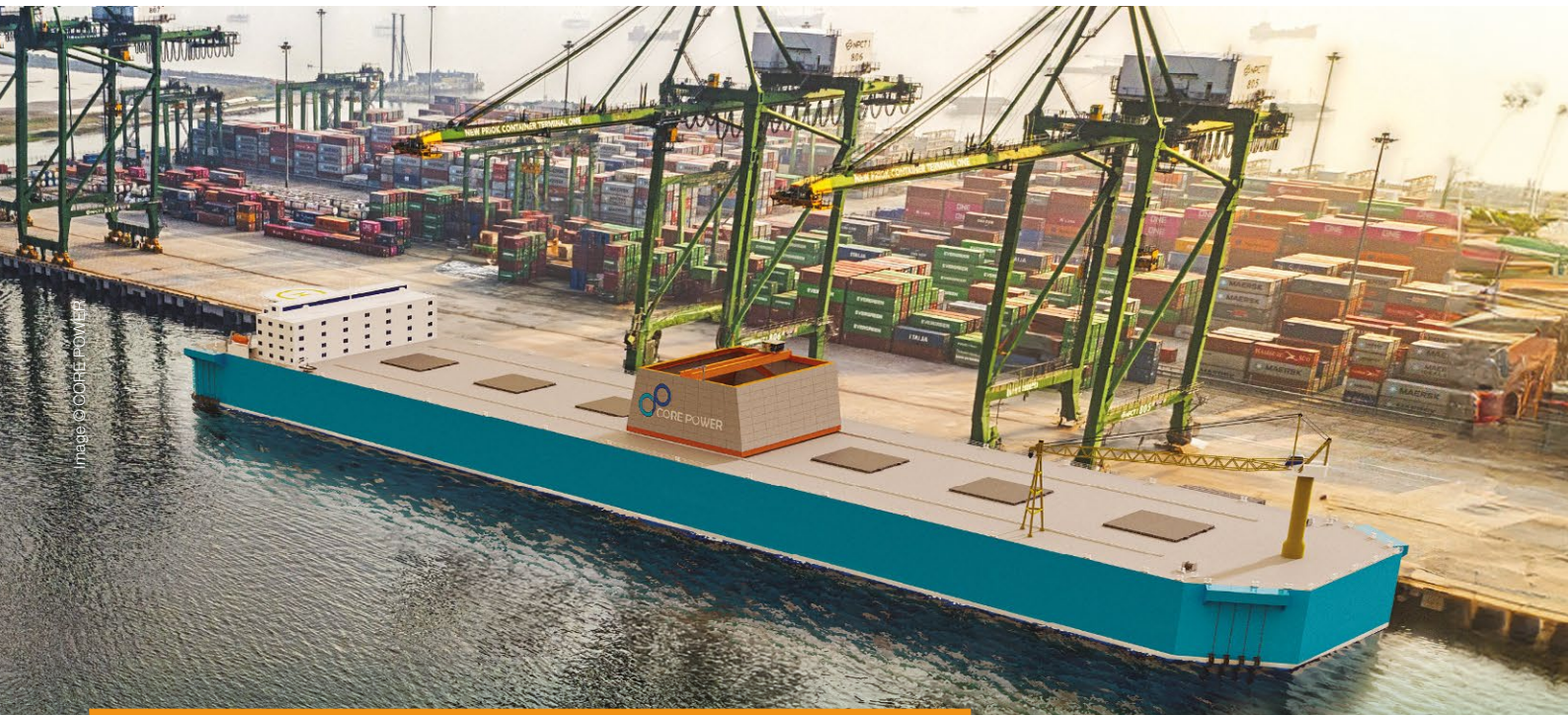

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Critical mass

Critical mass means reaching a tipping point for a particular change or development to happen. In physics, it is the smallest amount of fissile material that will produce a stable chain reaction, writes CORE POWER's **Unni Einemo**

Critical mass points to transformative power. In the nuclear energy industry, it is about harnessing the power of a controlled and sustainable chain reaction from fissionable material. There's more than one way to do this, which I will get back to in a bit.

For the climate, reaching a tipping point is a bad thing, as it signifies changes that pose existential risks to humans, not to mention biodiversity. With mounting evidence that climate change is already causing damage, public acceptance that we need to reduce climate-warming greenhouse gas (GHG) emissions has reached critical mass, signified by the historic Paris Agreement adopted by the UN Climate Change Conference in 2015. Not long after, in 2018, the International Maritime Organization (IMO) adopted its initial GHG Strategy, followed by an even more ambitious revised IMO GHG strategy adopted in July 2023. Meeting those ambitions – both the interim 2030 and 2040 GHG reduction targets and net zero by the middle of this century – will require transformative changes in the global shipping industry.

The Paris Agreement and the IMO's GHG Strategy have effectively put an expiration date on burning polluting fossil fuels. On shore, the focus is on electric power generated from GHG-free energy sources, meaning renewables or nuclear. For the transport sector, like shipping, that option is limited by the size and weight of batteries. Other solutions are needed to propel ships across our oceans, and it needs to happen while achieving GHG reductions on a well to wake basis.

As the maritime sector ponders its options, a growing number are waking up to the fact that nuclear energy can provide both emission-free energy to produce alternative fuels to help shipping with the energy transition, and power true zero-emission ships directly. With the momentum building, and the emergence of a new generation of advanced nuclear reactors, we are reaching the critical mass needed to overcome various hurdles that stand between today's fossil-fuel dominated shipping industry and a future of safe, sustainable, zero-emission ships powered by nuclear energy.

TRANSFORMATIVE TECHNOLOGY

Nuclear propulsion has been used by navies for seven decades on submarines, aircraft carriers and war ships. Civil use has so far been limited to icebreakers, plus a few state-owned cargo ships during the 1960s and 70s. Without a doubt, nuclear propulsion is very well proven and has an outstanding safety record. Moreover, these ships can operate for years without refuelling, a major efficiency and practicality advantage. So why is it not more widely adopted?

One key factor is economic viability. To date, it has not been possible to build and operate nuclear-powered ships that are competitive with conventionally fuelled commercial ships.

Fossil fuels have dominated shipping because they have been cheaper than the alternatives, and have provided a reliable, energy-dense source of energy for increasingly efficient marine diesel engines. We are now entering an era where policy tools are beginning to change the economics by introducing a cost on carbon emissions and penalties for not using a certain percentage of low-carbon fuels. These policy tools, whether regional like the EU's "Fit for 55" regulations or global when the IMO works out mandatory mid-term measures, will gradually tip market fundamentals in favour of nuclear-powered ships.

The other key factor preventing commercial uptake of nuclear energy in shipping is linked to the reactor technology. Both on shore and at sea, nuclear power plants have to date predominantly used pressurised water reactors (PWR). To prevent the release of radioactive material, the design and operation of all nuclear power plants prioritise safety and security through multi-layered Defence in Depth designs to prevent or minimise the impact of a potential accident or security incident. In addition, nuclear plants have emergency planning zones (EPZ) where plans must be in place to respond to potential incidents. For PWRs, the EPZ can span a large area because a release of radioactive material could be widely dispersed due to the pressurised nature of the system.

A large EPZ is incompatible with commercial shipping, as it creates large liabilities for the ship operators which cannot be commercially insured. No insurance, no port calls, no point.

These liabilities are underwritten by governments for naval and state-owned ships. If the EPZ is shrunk to near or within the boundary of the ship, however, commercial insurance becomes possible. New reactor technology is emerging that will make this possible and overcome other significant hurdles.

CORE POWER has been working on bringing advanced nuclear solutions to the maritime sector since 2018, and has identified key technology criteria. Minimal EPZ is one of them, to make floating nuclear power commercially insurable and enable operations in ports and nearshore environments. Reactors must be simple to operate and have inherent passive 'walk-away' safety systems, meaning they will safely shut down and seal in radioactive components without human interference. They should have very long fuel cycles to limit the need for refuelling and fuel handling.

A new generation of nuclear reactors, in various stages of development, has the potential to meet these technology criteria. If economically viable, this will be a truly transformative technology for shipping.

SMRS AND MSRS

SMRs and MSRs: these two acronyms signify developments that can address barriers to wider use of nuclear energy. Small modular reactors (SMRs) can significantly reduce the cost of nuclear energy, while molten salt reactors (MSRs) have inherent safety features which remove risks associated with PWR technology and allows for a very small EPZ. The latter, along with education, may also help alleviate public fears and misconceptions about the risks of nuclear energy.

Did you know, for example, that the fatality rate from accidents and air pollution caused by nuclear power generation, including the Chernobyl and Fukushima disasters, is 0.03 deaths per terawatt hour of electricity produced, compared to 24.6 deaths per terawatt hour of electricity produced by coal? This puts the mortality rate from nuclear energy on a par with solar and wind, and it has less GHG emissions per gigawatt hour than all renewables.

But I digress.

SMRs offer a wide range of end-user applications. They have a power capacity of up to 300 MWe per unit, and their design allows for factory assembly, an approach that can facilitate mass production and hence reduce costs compared to large fixed terrestrial plants, which in recent years have been plagued by excessive cost and schedule overruns. CORE POWER has identified further efficiency potential by adopting the integrated modular manufacturing processes used in the shipbuilding industry. This could enable high quality, repeatable processes and ultimately reduce the cost by using specialised shipyards to build nuclear-powered ships and floating nuclear power plants (FNPPs).

MSRs are very different from PWRs, which typically use pressurised water as both coolant and moderator for solid uranium fuel. In an MSR, the uranium is dissolved in molten salt. Controlled fission creates the heat that keeps the salt liquid, and this liquid therefore acts as both the fuel (producing the heat) and the coolant (transporting the heat to the power plant). Unlike a PWR, the MSR operates at ambient pressure which minimises the release of radioactive materials in case of an accident. If the reactor needs to shut down due to an emergency, the temperature drops, and the salt solidifies.

MSRs are not new. Valuable research and development took place during the 1950s and 60s, but there was then a long hiatus as PWRs became the dominant technology. Today, the benefits of MSR technology are widely recognised. CORE POWER is working with partners in the US and Korea to bring US-based TerraPower's molten chloride fast reactor (MCFR) to market. It is a long and painstaking R&D process that is costing millions, covered by private investors as well as US government funding, before a future MCFR demonstration reactor can begin operations, and followed a few years later by the first fully commercial MSRs.

CORE POWER believes the first ships with advanced reactors will be entering ser-

> 'We are reaching the critical mass needed to overcome various hurdles that stand between today's fossil-fuel dominated shipping industry and a future of safe, sustainable, zero-emission ships powered by nuclear energy'

> 'Nuclear energy can provide both emission-free energy to produce alternative fuels to help shipping with the energy transition, and power true zero-emission ships directly'

vice sometime between 2030 and 2035. It seems likely that floating nuclear power plants (FNPPs) will present the first opportunities for a new generation of marine advanced reactors, as they will not face the regulatory complexity of navigating between multiple jurisdictions.

NUCLEAR'S ROLE IN DECARBONISING SHIPPING

In the coming years, shipping will be required to use increasing volumes of alternative fuels produced using low carbon or carbon free energy sources. There are huge concerns about the availability of truly green fuels, especially as the shipping industry will be in competition with other industrial sectors and society in general for green energy.

One of the ironies about the fuels we're looking at to decarbonise shipping is the enormous amounts of energy required to produce the key building block, hydrogen. It will take almost twice as much energy to produce hydrogen than the energy you can extract from hydrogen through a combustion engine or a fuel cell. That's poor from an energy efficiency perspective, and it will make truly green fuels very expensive.

If you were to replace the current level of fuels consumed in international shipping with green ammonia, you would need over 80% of current global renewable electricity production to make the green hydrogen needed.

Supply of green electricity from renewables is growing fast, but demand from other industries and society is growing rapidly too. Another issue with renewables is weather dependency. I have solar panels on my roof, and they are great during the summer, but during the grey and short days of the UK winter they are of limited use. Unlike intermittent renewables, nuclear reactors provide a steady source of power 24/7/365, and nuclear power generation has a much smaller geographic footprint than solar or windfarms.

> 'FNPPs located at bunkering hubs in green corridors, using only seawater and air to produce carbon-neutral hydrogen and hydrogen-based fuels, could be the ideal solution to meeting demand from the marine fuels market'

FNPPs located at bunkering hubs in green corridors, using only seawater and air to produce carbon-neutral hydrogen and hydrogen-based fuels, could be the ideal solution to meeting demand from the marine fuels market. Take Singapore as an example. A tiny island nation with a population of almost 6 million, Singapore needs lots of energy but has very little space to produce it. Moreover, it has ambitions to build energy-hungry datacentres, and achieve net zero by 2050. According to an official at the country's Energy Market Authority, completely covering Singapore with solar panels would yield less than 10% of its projected 2050 grid demand during peak output hours. Wind power is not really an option in Singapore either, but it is surrounded by calm seas where FNPPs could provide reliable, sustainable and carbon free energy with the added benefit of giving Singapore energy independence. It could also give today's premier global marine fuelling port the means to produce alternative fuels for shipping in the future.

Around the world, there are growing requirements for ships to plug into shore power while in ports to prevent local air pollution, placing enormous pressure on existing grids. A nuclear-electric ship would not need to plug in and could, potentially, provide electricity to the port through reverse ironing, or FNPPs could help ports decarbonise operations by providing ports with their own independent microgrids.

All the alternative fuels (LNG, methanol, ammonia, hydrogen) require 2-3 times more space for fuel tanks and fuel systems than traditional oil-based fuels to sail the same distance, either because of low energy density or safety requirements, or both. So, you either have to give up cargo space, or bunker more frequently.

Uranium-235 used in nuclear reactors has 4 million times more energy per tonne than ammonia. This means a nuclear-powered ship would not have to sacrifice cargo space, and it could operate without refuelling for years, possibly decades, without any emissions of any kind. No other energy source can match it for energy density and the associated benefits of efficiency, reliability, and energy independence.

Today, less than 20% of the biggest ships are responsible for 80% or more of the industry's GHG emissions, so if you could begin to replace that section of the fleet with modern,

Image © CORE POWER

Unni Einemo

nuclear-electric ships during the 2030s, it would really help in reaching the IMO's target of reducing the overall GHG from international shipping by 70 to 80% by 2040.

INTERNATIONAL REGULATIONS

The IMO's Maritime Safety Committee (MSC) has recently started work on an agenda item called 'Development of a Safety Regulatory Framework to Support the Reduction of GHG Emissions from Ships Using New Technologies and Alternative Fuels'. This is considered urgent and important as it supports the IMO's GHG Strategy.

The outcome of work done so far is a list of alternative fuels and new technologies that can help reduce GHG emissions from ships. Nuclear power is on the list.

MSC 108, which met in May 2024, noted with appreciation MSC 108/INF.21 submitted by the World Nuclear Transport Institute (WNTI), containing a gap analysis of the IMO's Code of Safety for Nuclear Merchant Ships. The document highlights that the Code, which was adopted in 1981, is specific to early PWR designs and needs updating to reflect and accommodate positive technology developments.

> 'CORE POWER believes the first ships with advanced reactors will be entering service sometime between 2030 and 2035'

Discussions at MSC 108 showed growing recognition that the existing regulatory framework for nuclear-powered ships needs to be updated. Comments were also made about a need for synchronising work at the IMO and the International Atomic Energy Agency (IAEA) to create an appropriate international legal framework applicable to modern reactor designs on ships and floating nuclear power plants.

Around the same time, the head of the IAEA, Rafael Mariano Grossi, called for international collaboration in developing a roadmap to make nuclear energy a practical alternative to decarbonise shipping.

Getting the right regulatory framework in place will be complex and time-consuming, but stakeholders will be working hard to assist nuclear and maritime regulators in the development of appropriate standards and rules for the deployment, operation, and decommissioning of floating nuclear power. At CORE POWER, we will continue our efforts via WNTI and the newly established Nuclear Energy Maritime Organization (NEMO) to help unlock the potential of nuclear energy while upholding the highest safety, security, and environmental standards.

Unni Einemo,
Marine Regulations Lead,
CORE POWER

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A new ball game

Johannes Schurmann of FincoEnergies talks to ENGINE's **Erik Hoffmann** about new developments in the biofuels bunkering sector

Marine biofuel specialist FincoEnergies has been in the Amsterdam Rotterdam Antwerp (ARA) market for several years and established itself as perhaps the world's biggest supplier of biofuel blends to ships.

Countless shipping firms have grabbed news headlines through trialling GoodFuels' biofuels supplied by FincoEnergies to their ships. Various feedstocks have been tried and tested, with differences in performances and greenhouse gas (GHG) reduction potentials recorded.

ENGINE's Managing Editor Erik Hoffmann spoke to FincoEnergies' commercial director Johannes Schurmann to explore some of the more pressing questions and challenges around biofuels for bunkering. Have there been a lot of teething issues so far, where are we now, and what will a more GHG-regulated marine fuel future look like?

Erik Hoffmann (EH): We are seeing a wide range of price levels from various biofuel bunker suppliers in the Netherlands. These are given either for fuels based on feedstocks such as cashew nut shell liquid (CNSL), palm oil mill effluent (POME) or used cooking oil (UCO), which have different properties. Are there major differences in the performances of these fuels?

Johannes Schurmann (JS): If you look at POME and UCO, those are indeed different feedstocks that can have different properties. But it's not a given that they have different properties. POME is of course a waste product from the palm oil industry, but UCO could also be a waste product from palm oil.

We have quite some clients that want solely used cooking oil methyl ester (UCOME), which is biodiesel made from UCO, because they believe they have engine acceptance for UCOME. But in the end, it's impossible to prove that physical UCO ended up in the biodiesel. Only if you control the entire supply chain you could say: 'Okay, the physical UCO ended up in the biodiesel.'

It's very hard to base the quality of the biodiesel on the original feedstock if we are working with waste-based products.

CNSL is a totally different ball game. It's a fuel that we don't have much data about. We know that it has been used for some years in fuel oil blends. Some shipping companies are testing it, but there are also some nasty stories about all kinds of problems that occur with this product.

> 'CNSL is much cheaper than the biodiesels that we see today, but from a technical side, there are still quite some challenges that we need to overcome'

If you look at the composition of CNSL, it's composed of mainly carbonyls and anacardic acids, and those are different from the fatty acids that are well known in biodiesels.

It could be an interesting product for the future because there are quite some volumes available. CNSL is much cheaper than the biodiesels that we see today, but from a technical side, there are still quite some challenges that we need to overcome. So, to just start using it because it fits in the ISO 8217 specification, that is too easily said.

POME should not be confused with virgin palm oil, but how can a shipowner know that a POME-based biofuel is actually POME and not something else?

We have been looking at POME for a while. In the Netherlands we have worked with this Dutch HBE [*hernieuwbare brandstofeenheden*] system, that does allow certain feedstocks to be used for international shipping if they are eligible for those HBEs, those bio tickets. And 2-3 years ago, they narrowed down the feedstock list which pushed us towards POME.

We didn't use it before because we were scared of this 'palm' word in the feedstock, and if you can use UCO or tallow, why look at POME? Due to the legislation we had to look at POME.

What we did was first look at where this POME comes from. It's mainly coming from Southeast Asia – Malaysia for example, Indonesia as well. To prove that the POME is really a waste product, we need to rely fully on the ISCC [International Sustainability & Carbon

Certification]. The ISCC is certifying basically all the parties in the chain, including the ones producing POME.

And when the auditors visit sites that are producing POME, they are checking whether those sites are actually increasing or decreasing the amount of POME that they produce on a yearly basis. They say you cannot produce more than you did in previous years. Those auditors are really looking to make sure that you are not purposely producing POME. We think that this is a good mechanism.

A better way to check that they're not purposely producing POME is to see whether they even have a financial incentive to produce POME. And what we have done over the past years is that we have checked the POME price, so the raw feedstock, compared to palm oil.

What you see is that most of the time, not always but most of the time, the price of palm oil is higher than the price of POME. If the price of palm oil is higher than the price of POME, then for the producers of POME, there is no incentive to optimise the waste products rather than their premium product, which is palm oil.

You have been looking into various ways of tracking feedstocks. Are either physical and blockchain tracers being used to guarantee that a biofuel's origin and supply chain is what it says on the Proof of Sustainability (PoS)?

> 'We know from a lot of our customers that they are struggling to sell the emission reductions of their consumed biofuels to their cargo owners'

Setting up a chain where a lot of mass balancing is done on paper, and setting up a chain with a physical tracer in there is extremely hard because you need to put tracers in all the big pools of feedstocks. You need to be able to track them to the vessel with a bunker sample for example, including what the dilution is of each tracer that you put in the original feedstocks.

Then you need to link those together – the tracers you find in the bunker sample and the tracers you've put in the original feedstock. In reality, we see that it is insanely hard to organise that. And it is quite costly because you need to physically put tracers in all those feedstocks. Because they're coming from all over the world, it's quite costly to organise that. From a physical side, we are not yet convinced that such a system would work.

The only benefit we found during trials, is that onboard the ships you have many different fuel tanks, and to have a tracer in the bunkers that you actually supplied to the ship could be beneficial because then onboard you can prove that if some problems occur, for example with the separator or in the engine, you can prove whether it was your fuel or not that led to a problem.

Regarding the digital tracers, we have been looking into blockchain solutions already for years. But we also see that this ISCC chain is quite solid. In Europe, we will start working with the Union Database soon. It's a European-wide database for all biofuel streams and everybody participating in the European schemes will need to fill in their mass balance in that system, so that they can basically keep track of all movements of biofuels.

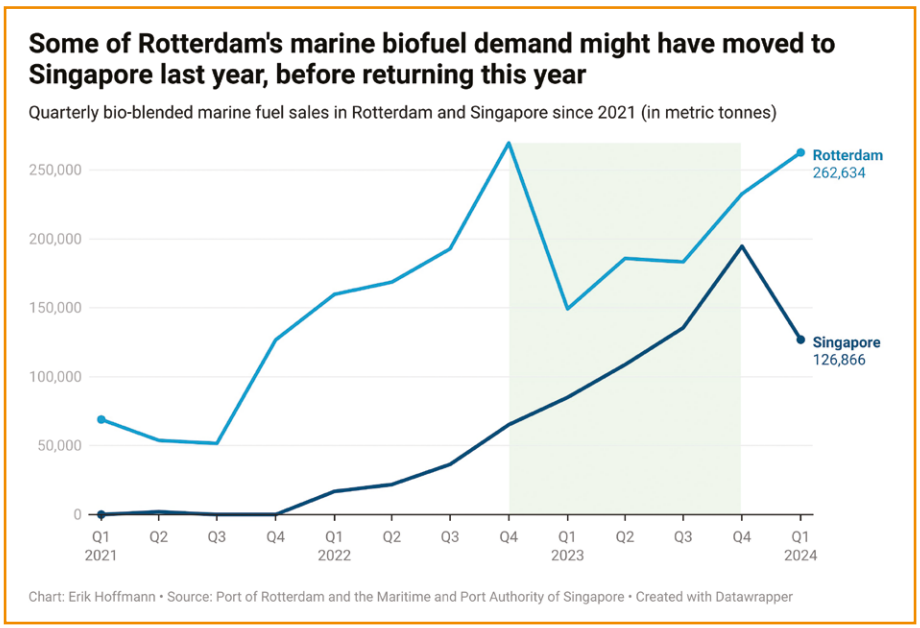
If you at some point adopt such a system globally, that would be very strong, but it's definitely a good start that we have this unified database in Europe. I would say such a database is stronger than if we had worked independently as companies with blockchain technologies.

Rotterdam's total bio-blended bunker sales surged from 301,000 mt in 2021 to 791,000 mt in 2022, but then they unexpectedly dipped to 751,000 mt last year. Why was there a declining trend?

It's based on multiple factors. And what we have seen, and we think has the biggest impact, is that Singapore biofuel bunker sales spiked a lot. There has been some movement away from the Netherlands to Singapore. Of course, what we also see in the Netherlands is that general bunker fuel consumption declined year-over-year from 2022 to 2023. The share of biofuel, or at least the absolute consumption of biofuel, went down in those years. And fossil as well.

We see a tendency that LNG has better economics. I think the LNG business has had quite some tough years in 2022-2023,

GoodFuels tested isotopic tracers as a 'unique fingerprint' in a biofuel stem delivered to a Norden-owned tanker in 2022. Image: GoodFuels



> 'We maintain a stock of bio-methanol, but when demand from methanol-powered container ships exceeds our stock, we complement our shipments with mass-balanced methanol to meet these larger volumes'

and in 2021 as well a bit. But we see a lot of new vessels with LNG engines. We see that the LNG business is getting more traction again. So that is definitely an impact.

And maybe the last impact is that in the early years of biofuel adoption, especially in 2022, there were a lot of cargo owners pushing biofuel consumption because they wanted to decarbonise their supply chains in shipping.

Since last year, and especially this year, we have seen some economic headwinds. We see that there is less interest from cargo owners to pay extra for sustainable supply chains. Therefore, we are lacking a push from the cargo owner side to bunker more sustainable fuels. We know from a lot of our customers that they are struggling to sell the emission reductions of their consumed biofuels to their cargo owners. **Have you seen any demand help from the EU ETS this year, and do you expect the combined effects of a more phased in ETS, and FuelEU Maritime, from next year to bring biofuels more into the mainstream as a fuel for EU-trading ships?**

I think it will become more interesting, but it still doesn't close the gap. For FuelEU Maritime, of course, everybody will use some alternative fuel, whether it's LNG or biofuel or methanol. But I think most companies will comply with the bare minimum of FuelEU Maritime rather than exceeding it.

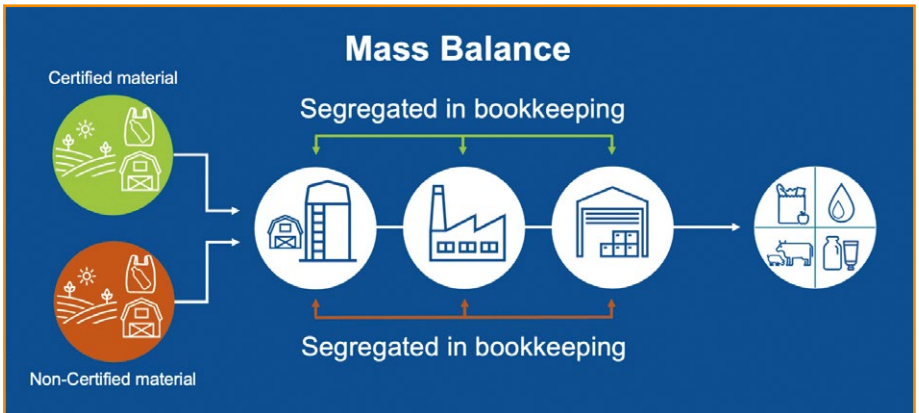
In the Netherlands, we have this incentive system still, the HBE system. Hopefully it will be there next year as well. And then maybe the combination of the three of them, so EU ETS, FuelEU Maritime and a local incentive, can make large uptake of biofuels interesting again. **And with the avoidance of double-counting it by having it in one place, you have the HBE PoS that has to be retired with the Dutch authorities, and then you have the EUA PoS that you can't get necessarily, what you can get is a PoS copy...**

Yes, there is a solution in the make for that, and that's been pushed by aviation because aviation is in the same boat as we are. And they are pushing for a system where the PoS can be retired with a governmental body like the Dutch Emissions Authority.

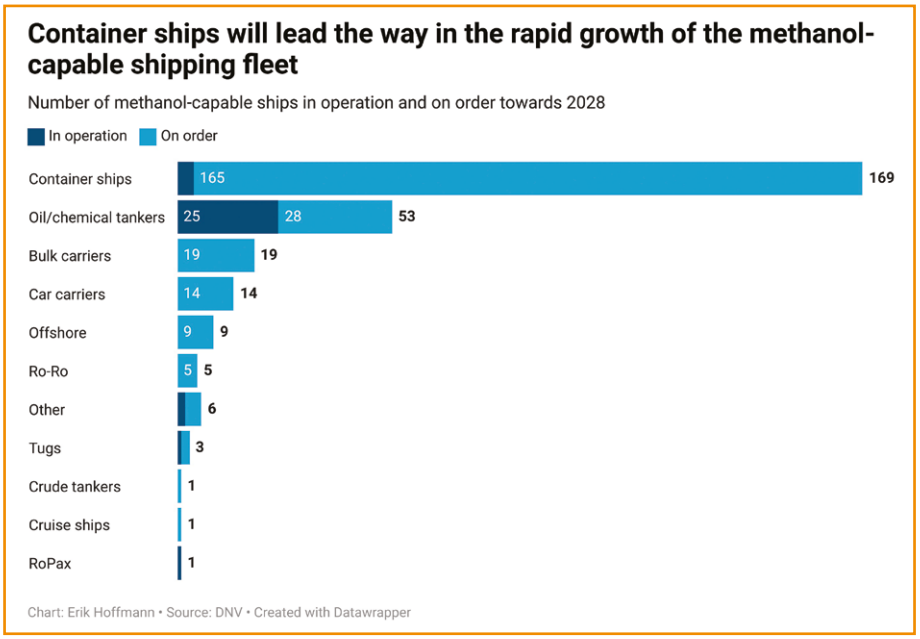
There will then be a document created and that's called a 'Proof of Compliance'. Where the PoS today has a blue colour, the Proof of Compliance will have an orange colour and it will have a different status than the PoS. The PoS can really be used when you trade products and can be handed over to the new party in the chain, while the Proof of Compliance is for the end consumer. What it will look like is that we as a fuel supplier will provide the PoS to the Dutch Emissions Authority and we use that data to create a Proof of Compliance, and we share that with the shipping company. They can in turn provide that to the relevant authorities to prove compliance with the EU ETS, FuelEU Maritime and future IMO regulations.

It's a document in the make, it's not yet there. I know on the aviation side, certification organisations together with the European Commission are still working out some details, but hopefully they will start implementing that soon and that will solve quite some headaches. **How do you assess the long-term prospects for bunker suppliers to access sufficient bio-feedstocks to fuel a greener global fleet in the years and decades to come?**

Most shipping companies have to rely on contracts with fuel suppliers like us to provide them with sustainable biofuels or sustainable fuels – not per se biofuels. And we see a tendency that more and more shipping companies are asking for long-term agreements and then we are talking about, let's say agreements up to 2030.



Mass balancing is a bookkeeping method used to track flows of sustainable feedstocks in the supply chain. It allows renewable and non-renewable feedstocks to be blended while keeping a tally of them across production, distribution, blending and bunkering. Image: ISCC



The only thing that we can do is that we offer prices based on indexes, for example a UCOME index which is a well-known index in the biofuel industry. What we see is that the shipping companies are not very familiar with those indexes and that they base their business models mainly on the fossil indexes, like ICE Gasoil, Platts… and the indexes that are used for fossil. So, they will rather price long-term agreements on those fossil indexes because then they know exactly what the impact will be on their business cases, rather than a bio index that can go up and down massively.

When proposing those long-term agreements to clients, we also have to secure our risk. We have to work with those bio indexes. And then once we come close to signing such long-term contracts, we see that they often jump out because they cannot foresee the risk they are committing to.

We see today that sourcing of feedstocks is not a problem. It depends a little bit on what kind of feedstock you are looking for, but in general we can get hold of any feedstock we would like for our customer. So, for the coming years, we don't really foresee that as a deal-breaker. In the long run, of course the biodiesels that we use today will be in short supply.

We are also working at those so-called bio-oils and those could be made from lignocellulosic feedstocks. So roadside grasses, woody waste… But we see that technology is not yet there. So we are still investing together with a lot of industry partners and are funded even through European Commission projects.

We are doing our best to expand our portfolio to make sure there will be supply in the future. But it's a chicken and egg story as you've heard before. Demand needs to be there to give enough push for technology developments and supply chain developments.

'Our aim is to expand gradually, evolving from a smaller-scale bio-methanol supplier into a leading name in the methanol marine fuel industry'

So with the bio-oils, is there estimated to be greater overall long-term potential for feedstocks in that area than for the more traditional biofuels?

The potential is way higher for bio-oils than for the waste fats and oils that we are using today. We recently had a bio-oil summit organised by the Maersk Mc-Kinney Møller Center for Zero Carbon Shipping, where engine makers, some shipping companies, technology providers all came together again to put our heads together to see whether we can make this fuel work.

We see in those type of organisations that they are still interested in a big push for those bio-oils. And the main reason for that is that the cost price of those bio-oils is just way lower than for using green hydrogen to produce either ammonia or methanol. The shipping industry always tends to use the cheapest fuel there is and they will be doing so for decades.

FincoEnergies also has a permit to supply bio-methanol in Amsterdam. Have you registered any interest for future spot or term volumes for bio-methanol from owners with methanol-capable ships in their orderbooks?

We are proud to be one of the few suppliers of physical bio-methanol in the ARA region, a product that stands out because its biogenic origin can be verified. Alongside bio-methanol, we also provide mass-balanced and conventional (grey) methanol for blending purposes.

Regarding bunkering operations, we have set up possibilities throughout the ARA region via two methods: we have a specially dedicated bio-methanol bunkering truck, authorised for operations within the Port of Amsterdam and we offer methanol via barge in the rest of ARA as well.

Methanol in shipping is currently in the early adopters phase. Although the current number of vessels capable of using methanol is limited, there is a noticeable increase in orders for dual-fuel methanol vessels, signalling a growing interest in this alternative. However, the choice for these upcoming vessels remains between regular biofuels or green methanol variants. The choice often hinges on cost, and methanol is currently generally more expensive.

All in all, we want to be prepared. By offering both GoodFuels biofuels and bio-methanol we cover the complete spectrum.

So you are setting up now for the future in the sense that you will have all the logistics and everything ready for when that demand comes. And then there might be major container ships that are signing up to all of it, right?

So those are the conversations we have today. We have it in stock, but the container ships that are burning methanol today, sometimes require quite sizable stems. And to start from zero to hero, that's not really the way to grow. We are not stocking 5,000 mt of bio-methanol all at once, while those vessels might require that.

We maintain a stock of bio-methanol, but when demand from methanol-powered container ships exceeds our stock, we complement our shipments with mass-balanced methanol to meet these larger volumes. Our aim is to expand gradually, evolving from a smaller-scale bio-methanol supplier into a leading name in the methanol marine fuel industry.

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Scaling up

Drawing on the findings of a new BNEF report, **Alexander Döll** of the Methanol Institute looks at how methanol can help the shipping industry achieve next zero targets

Image © Shutterstock

Delivery of the methanol dual-fuel vessels currently in the newbuilding orderbook will see demand for the low carbon fuel explode in the next few years, according to *Scaling Up Hydrogen: The Case for Low Carbon Methanol* published by the Bloomberg New Energy Foundation (BNEF).

The report estimates around 14 million tonnes of the fuel could be needed annually by 2028, assuming all the dual-fuel methanol ships use methanol only, with practically all of it going to meet the demand of containership operators.

This has led some of the biggest operators to lock in fuel supply and move further up the energy supply chain to secure the quantities of fuel they need. This change to the established model of marine fuel supply is needed across the board to provide the necessary demand signals and stimulate supply, BNEF finds.

At the same time, expanded investment in bunkering and fuel supply infrastructure is needed. For the operators which are making the investment, European Union (EU) regulation is levelling the playing field between alternative and existing fuels.

NET ZERO OPTIONS

While digital technologies provide an opportunity for sizable efficiency gains and emission reductions, they can only decrease fuel consumption rather than eliminate emissions. Options such as sails and other propulsion modes remain at a far earlier stage of development, despite their long-term potential.

BNEF concludes that the most viable near-term options for lower carbon in shipping consist of various low- and net-zero carbon fuels, such as biofuels, low-carbon methanol, bioLNG, low-carbon ammonia and other synthetic fuels. All these come with unique challenges related to availability at scale, sustainability, cost and safety.

Low-carbon methanol is a more readily available option than other alternative fuels and has been one of the main choices, alongside biofuels and bioLNG, in shipping companies' net zero plans. Ammonia is also considered a potential clean shipping fuel.

In the context of limited overall supply of cleaner fuels, and competition from other transportation sectors, a potential question is whether the industry will settle on a single or multi-fuel future. Both options come with their own challenges.

PROGRESS IS SLOW

Container liner operators have led the way in setting net zero emissions targets but represent less than 30% of shipping's total bunker fuel consumption. The seven container shipping companies with net-zero goals account for 54% of container vessel capacity globally, which is the highest percentage among all ship categories.

However, containerships account for roughly 27% of total fuel consumption in the shipping sector while bulker and tanker sectors combined represent over 50%.

Just 10% and 8% of operators in the (much larger) dry bulk and tanker sectors – only

'While the shipping sector has ordered enough ships to consume over 14 million tonnes of low carbon methanol within the next five years, there continues to be uncertainty surrounding the supply chain'

five dry bulk carrier and three tanker operating companies – have net-zero targets.

The lack of differentiation among dry bulk, oil and chemical products – and their role as raw materials – implies that a large portion of cargo owners have not yet recognised the higher value of green fuels.

Using the percentage of vessel capacity as a proxy for fuel consumption in each vessel type, NEF estimates that net-zero targets account for just 20% of shipping's total fuel consumption.

THE METHANOL ADVANTAGE

While vessel engines can be retrofitted to accommodate methanol, bunkering infrastructure including storage tanks, refuelling equipment and barges in the port, could be a more important factor in determining which fuel will dominate in a net-zero future.

As a more widely traded commodity than ammonia, methanol is seen to have an edge over ammonia, with more ports readily equipped with methanol storage tanks. It is also easier to retrofit gasoline or oil tanks to store methanol, compared to ammonia, NEF suggests.

However, for methanol to be widely used as a shipping fuel, the existing infrastructure is far from sufficient and significant investment in both existing and new bunkering ports is needed.

It notes that methanol has a first-mover advantage over ammonia to occupy and lock in port infrastructure as the first batch of low-carbon methanol projects start to sign offtake agreements.

Once methanol fuel producers secure long-term offtakes or investment from shipping buyers, they could then approach the port infrastructure providers to secure storage space or even coinvest in the infrastructure expansion.

BUNKERING PARTNERSHIPS

The Port of Rotterdam in the Netherlands bunkered 1,500 tonnes of methanol in 2022 and expects to be a regular methanol bunkering hub in future, with partnerships happening somewhat organically in Rotterdam. As shipping companies such as Maersk and X-press Feeders announce plans to procure and bunker low-carbon methanol in the port, biofuel producers such as OCI Global are starting to engage with bunkering stakeholders. This could be a useful template for other large ports, BNEF suggests.

In terms of getting regulatory approval, Rotterdam only requires an advance notice for methanol bunkering, which is more straightforward than some other ports that have not bunkered methanol before and might require longer engagement with the port authority.

Producers are partnering with bunkering operators, changing the business model for fuel supply. For example, OCI Global has partnered with Unibarge, one of the largest bunkering operators in Rotterdam, to charter its barge for bunkering services.

However, fuel producers will need to secure some sort of storage infrastructure in the port. As one of the largest methanol trading hubs, Rotterdam has around 500,000 cubic metres (around 400,000 tonnes) of methanol storage infrastructure.

Fuel producers will need to sign some sort of contract, usually one to three years in length, with storage infrastructure providers to justify their upfront investment. This happens for other types of green fuel already, such as the ones by Vopak in Los Angeles and in Rotterdam for sustainable aviation fuels.

As most gasoline and chemical tanks are easy to retrofit to store methanol, some storage tank owners could go ahead and expand their methanol storage without needing long-term fuel contracts. For example, storage provider EVOS has announced plans to expand its methanol sites in Rotterdam.

'For methanol to be widely used as a shipping fuel, the existing infrastructure is far from sufficient and significant investment in both existing and new bunkering ports is needed'

UPSTREAM AND DOWNSTREAM

While the shipping sector has ordered enough ships to consume over 14 million tonnes of low carbon methanol within the next five years, there continues to be uncertainty surrounding the supply chain, the research finds.

The shipping sector is struggling to absorb the additional costs of alternative fuels. This is – in part – slowing the development of low-carbon methanol projects, which would require binding offtakes and a decent return to justify the upfront investment.

Without bigger demand commitments, low-carbon methanol producers and ports might also be hesitant about investing in methanol bunkering infrastructure, further negatively impacting shipping companies' ability to rely on low-carbon methanol as their primary fuel.

One way to secure a low-cost and stable supply of clean methanol would be for shipping companies to go actively upstream in developing the green fuel supply chain. This would help spread the demand signal across the supply chain, accelerating the project financing timeline and possibly driving down costs.

Building a larger volume of suppliers and getting shipping companies involved in fuel sourcing and producing can potentially reduce costs in several ways: the more production there is, the greater the competition on prices; the greater the market size, the better the economies of scale due to the fact supply chains mature faster; and the involvement of shipping companies might help reduce the project risk profile for investors, thereby reducing the cost of capital.

Shipping companies could also look down-

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As the decade moves towards 2030, a key milestone in the International Maritime Organization's revised greenhouse gas strategy, ARACON 2024 will consider what a fit-for-purpose bunker industry of the future should look like – and what are the steps that companies should be taking now to remain aligned with clients' expectations and also be competitive.

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stream to identify the cargo owners that want to procure zero-emissions shipping services. A book-and-trade system provides a flexible chain of custody system, where cargo owners can easily claim the emissions reduction from voyages powered by green shipping fuels, would be a good model to explore. Another concept to explore is mass balance which documents and tracks renewable inputs through complex manufacturing systems and can be used where sustainable inputs are combined with traditional fossil-fuel-based inputs.

CHALLENGES OF OFFTAKE

For ships affected by the EU's regulations, the increasing compliance and fuel-switching costs are putting a financial burden on shipping companies. Ships that fall under the EU Emissions Trading System (ETS) regulations consumed 44 million tonnes of heavy fuel oil-equivalent fuel in 2022, which is around 18% of the annual 240 million tonnes of total fuel consumption of the shipping sector.

While a hike in freight rates saw the sector generate a record-high profit of over $200 billion in 2022, according to Sea-Intelligence estimates, it is common for shipping companies to have low single-digit, or even negative, profit margins. Fuel is the main cost driver for the sector, accounting for 20-30% of a container shipping company's total expenses.

Doubling fuel expenses could – in normal markets – tip operating margins into the negative. To bear the weight of the increasing costs of shipping, companies are trying to identify corporate customers that understand the value of green products and want to procure zero-emissions shipping. Quite a few international brand owners do want to commit to green shipping services to reduce their Scope Three emissions.

'OCI Global has partnered with Unibarge, one of the largest bunkering operators in Rotterdam, to charter its barge for bunkering services'

MAKING METHANOL COMPETITIVE

The economics of methanol-powered ships are unlikely to approach those of equivalent vessels using conventional marine fuel oil in the short term. The total cost of ownership – an all-in figure including capital, fuel and operating costs – for containerships using low-carbon methanol will certainly remain higher than those using fuel oil throughout the 2030s.

The declining costs of hydrogen will gradually close that gap, but even by 2050, when hydrogen could potentially be produced for as little as $1 per kilogramme, the total cost of ownership of low-carbon methanol ships would still be higher than those running on fuel oil.

Taking into account the environmental costs of burning fossil fuels can alter this picture, making low-carbon methanol as economic as, and even cheaper, than marine fuel oil, the report finds. Such conditions currently exist only in the EU as a result of the bloc's carbon price and the fines associated with the FuelEU Maritime (FEUM) regulation.

Any ship or cargo owner who must purchase allowances to cover their emissions under the EU ETS and also be subject to the fine for non-compliance with the FEUM regulation, will find that operating green methanol-powered ships within the EU (versus international trading) becomes the cheapest option, together with biofuels and bioLNG, even within this decade.

The methanol economics for routes that connect EU and extra-EU ports could break even with those using marine fuel within the 2030s. Shipowners might be able to remain compliant in the near term by adopting some efficiency improvements.

The economics of methanol-powered container ships might not apply for tankers and bulkers for extra-EU voyages, which have a lower total cost of ownership. Overall, the CO_2 emissions that collectively fall under these two EU rules are less significant at around 14% of global shipping emissions.

POLICY RECOMMENDATIONS

Scaling the uptake of low-carbon methanol faces challenges on both the supply and demand side. Some view existing demand-side regulations as not yet sufficient for the chemicals sector to adopt low-carbon methanol, and supply-side policies as currently too weak to incentivise production.

To mobilise the debate, BNEF suggests that policymakers should consider complementing commercial actions by customising demand-side regulations, ramping up incentives and support for producers and establishing a clear standard on carbon utilisation for green fuels.

Policymakers could consider offering more supply-side subsidies to reduce the feedstock cost for low-carbon methanol production. As hydrogen accounts for the biggest portion of e-methanol costs, and possibly also for hydrogen-injected bio-methanol costs, support for it should be prioritised to match the demand-side regulations on shipping. This could be delivered in the form of an auction or contract for difference.

The FEUM and IMO regulations, both of which set a carbon intensity target for shipping fuels until 2050, are currently some of the most effective demand-side policies for that sector's decarbonisation. As the shipping sector has not reached a consensus on which fuel will dominate in a net-zero future, providing a guide for carbon intensity could provide different fuels a fair playing field to compete on, and allow shipping companies to figure out the best fuel portfolio for compliance.

Alexander Döll,
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Lessons learned from LNG

Andrew Stafford from Trelleborg Marine and Infrastructure explains how the lessons learned from scaling LNG bunkering can help to prepare for a multi-fuel future

Dubai-headquartered Trelleborg Marine & Infrastructure has built up considerable experience and knowledge in LNG custody transfer and bunkering, and company's Technical Director Andrew Stafford believes that the key operational lessons learned from scaling LNG bunkering can also be applied to alternative fuels like methanol, ammonia, and hydrogen.

In this Q+A, he also highlights the importance of standardised fuel transfer guidelines, the role of the Society for Gas as a Marine Fuel (SGMF) in the fuel transition, and the need for comprehensive crew training to ensure success.

What are the main operational lessons that have been learnt through the scaling of LNG bunkering and how can these help shape preparations for the use of other alternative fuels?

LNG bunkering has become almost a standard occurrence within the maritime sector over the last 10 years. Despite a slow start and many obstacles, having a fleet of almost 1,000 vessels either delivered or on order is testament to the benefits that LNG as a fuel offers.

The scaling of LNG bunkering has provided several key operational lessons, particularly in areas such as safety, handling, transportation, and infrastructure development. Assessing the compatibility between the receiving vessel and the LNG delivery vessel, compared to a heavy fuel oil (HFO) transfer, is crucial. This extends beyond bunker transfer equipment to include emergency shutdown (ESD) systems and mooring compatibility, as outlined in LNG Bunker Management Plans.

More broadly, one critical insight is that the initial success of alternative fuels on short trade routes or domestic ferry operations does not always translate seamlessly to international voyages due to the different logistical and regulatory challenges involved. Inconsistent supply networks, especially for true green variants of alternate fuels, are also proving to be a barrier for vessels operating on global routes. The patchwork of varying traceability requirements and the lack of continuous high-volume delivery infrastructure at ports highlight the need for more integrated fuel supply chains supported by standardised solutions.

Fuel providers and shipping companies that have an interest in methanol and ammonia can benefit from understanding the LNG industry's experience, taking learnings from large-scale rollouts with well-established safety protocols, handling procedures, and transportation logistics. Meanwhile, hydrogen is likely to follow a more experimental project-based path initially, which might lead to unique scaling issues. So, early planning for standardisation and scalability in infrastructure and operations will be crucial to overcoming these challenges for all alternative fuels.

All fuels need basic, consistent fuel transfer guidelines, especially for transfers and managing emergencies, but there is currently no code and/or timeline on when these are likely to be implemented for alternative fuels. What are your views on this?

The IGF Code, originally created for LNG, provides the legal requirements for using LNG as a marine fuel. Based on industry working best practices, it includes mandatory criteria for the arrangement and installation of machinery, equipment and systems for vessels operating with gas or low flashpoint liquids as a fuel to minimise associated risks. However, as the industry shifts towards a broader array of alternative fuels, adaptations to this code are necessary. Interim guidelines can help – but with the full updated IGF code not expected until 2028, this leaves early adopters to rely on interpreting what the equivalent safety practices are to gain approval from classification societies.

This situation creates a gap in consistent regulatory guidelines, which are crucial for ensuring safe fuel transfer and emergency operations across all fuel types. Once

the updated IGF Code is published, it will enable the industry to standardise safety practices, and subsequent guidelines can be developed based on these established rules. Without this framework, any preliminary guidance is prone to frequent revisions, which will in some cases result in instability.

What role is SGMF taking in helping to facilitate the transition to alternative fuels?

To support the maritime industry's efforts to reduce emissions, SGMF is broadening its focus towards methanol and ammonia as alternative fuels and is currently developing guidelines to help the shipping industry safely and sustainably adopt these fuels once they become more common. Active working groups for ammonia and methanol are already in place, and although specific publication dates are yet to be confirmed, the initial guidelines are expected within the next 12 to 18 months.

Methanol has garnered interest due to its liquid form at ambient temperature, environmental benefits, and adaptability across industries. SGMF's guide, *Methanol as a Marine Fuel – An Introduction*, provides essential knowledge about methanol's chemical properties and its potential as a marine fuel. Similarly, ammonia is recognised for its significant environmental advantages, notably its carbon-free combustion. The guide, *Ammonia as a Marine Fuel – An Introduction*, now in its second revision, highlights ongoing studies and industry collaboration aimed at developing ammonia-powered engines. Having led the industry in the use of LNG for over a decade, SGMF continues to spearhead efforts in the safe and sustainable use of future fuels.

Upcoming expansions to these guidelines will include information about bunkering safety for both methanol and ammonia, as well as a range of other alternative fuels.

Are there any areas for crew training that are particularly important? Based on your understanding of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), is there anything of note that is currently being developed or that the organisation should be urgently turning its attention to?

We believe that the current STCW standards serve as a strong foundation of qualification, and that further comprehensive training on handling alternative fuels is always valuable. Given the operational risk management (ORM) implications of new fuels and associated infrastructures, evolving and enhancing training standards is crucial. For example, enhanced training that includes the physical handling of bunkering equipment within confined refuelling areas would give a valuable level of familiarity before operations begin.

As the industry adapts to these changes, it is essential to share best practices and insights beyond the scope of STCW courses. This can be facilitated through resources such as P&I clubs, industry bodies, classification societies, and marine fuel providers. Although regulatory updates may be slow, this collaborative approach can help bridge the training gaps and ensure that crews are better prepared for the challenges ahead. Enhanced and more focused training should be prioritised to ensure safety and operational efficiency.

How has Trelleborg responded from an innovation perspective to support the growth of LNG bunkering?

Trelleborg is deeply involved in the fuel transition, actively supporting the growth of LNG bunkering through innovation and strategic participation in the industry. Our involvement in industry events is driven by our strong belief in the importance of sharing insights to facilitate a multi-fuels future. Our product portfolio, including Bunkering Safety Links (BSL), Quick Connect/Disconnect Couplings (QCDC), hoses, and fenders, is designed to accommodate a wide range of alternative fuels.

Notably, advancements such as the integration of telecommunications to BSL systems and the development of the cryo-FC coupling, which allows for quick hose connection directly to a flange face, highlight our commitment to technological progress. Additionally, Trelleborg is an active member of several industry bodies such as SGMF, contributing our experience and technical knowledge to help shape regulatory frameworks and industry standards.

From an operational / technical perspective, what do you see as being the main barriers to using a variety of different bunker fuels (availability and price, aside) and what steps should the industry be thinking about collectively in anticipation of this?

Crew training and familiarisation remain a challenge in driving the adoption of various fuels. Unlike the frequent handling of bulk fuel as cargo, bunkering is a relatively infrequent task, often performed only once or twice during a crew's contract onboard. Given this infrequency and the possibility of crew rotation across different ship classes with varying fuel requirements, it is crucial to ensure a high degree of commonality in handling procedures to maintain safety standards.

To address these challenges, the industry should focus on standardising bunkering guidelines and adapting training programs. This would ensure that crew members are well-versed in the specific requirements and safety measures associated with different fuels, thereby minimising risks during bunkering operations.

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Leading the charge

Allyson Browne of High Ambition Climate Collective looks at the efforts underway to decarbonise U.S. ports and maritime infrastructure

As the world grapples with the escalating impacts of climate change, ports hold immense power to lead the charge towards a sustainable future. These bustling hubs of international trade are not just gateways for goods but prime catalysts for global environmental change. Maritime activities currently account for approximately 3% of global carbon emissions, releasing pollutants that disproportionately impact nearby communities. As climate change intensifies, the resilience of port infrastructure is increasingly tested, demanding immediate and decisive action. Port electrification is no longer an option: it is an imperative for mitigating climate impacts, adapting to new environmental realities and building resilience for the challenges ahead.

Last summer, the International Maritime Organization (IMO) adopted the 2023 Strategy on Reduction of GHG Emissions from Ships. This strategy aims to peak GHG emissions from international shipping as soon as possible and achieve net-zero GHG emissions by 2050. It also calls for a 40% reduction in carbon intensity of international shipping by 2030. While the strategy focuses on shipping, it necessitates significant action from ports, which must develop the infrastructure and capacities to enable vessel electrification and bunker clean fuels. Additionally, ports must address the evolving needs of shore-side operations and the electrification and fuel-switch for cargo-handling equipment, heavy-duty vehicles, harbour craft, rail, and aviation where applicable.

Simultaneously, ports are facing increasingly severe and frequent storms, a rise in sea levels and the responsibility to protect and preserve critical coastal ecosystems. In 2022, Environmental Defense Fund's (EDF) report *Act Now or Pay Later: The Costs of Climate Inaction for Ports and Shipping* found that, without ambitious action to reduce emissions, climate change impacts could cost the shipping industry up to $25 billion every year by the end of the century: 'Based on past impacts and anticipated climate change scenarios, the report projects that the additional annual damages to port infrastructure could reach nearly $18 billion by 2100. Storm-related port disruptions could add another $7.5 billion each year, reflecting the economic losses incurred by ports, shippers, and carriers due to port closures and the costs to shipping customers. Together, these added future costs due to climate change are roughly equivalent to the total annual net earnings for the container port sector in 2019.'

> Port electrification is no longer an option: it is an imperative for mitigating climate impacts, adapting to new environmental realities and building resilience for the challenges ahead'

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'Without accelerated infrastructure development, including utility, transmission and distribution systems and clean energy resource development, ports will struggle to meet their decarbonisation targets'

PortMiami

The call to action is clear: port climate action planning must account for mitigation, adaptation, and resilience – ensuring ports can meet industry needs to decarbonise while preparing for and adapting to the realities of a changing climate.

In the U.S., federal funding for port climate action planning, technology deployment and infrastructure development underscores the urgency and unprecedented opportunity to advance these efforts. The Bipartisan Infrastructure Law and the Inflation Reduction Act have committed over $20 billion to support port infrastructure and waterway improvements and decarbonisation, including the $3 billion allocation in the Inflation Reduction Act's EPA Clean Ports Program, which will fund zero-emission port equipment and technology; help ports develop climate action plans to reduce air pollutants; improve air quality and public health in neighbouring communities; and, advance environmental justice.

NAVIGATING THE COURSE

Despite a clarion call to action, significant challenges persist, and a great chasm exists between leaders and laggards. U.S. ports are motivated to decarbonise by various drivers, including state and local regulations, customer demand and community pressure. These drivers often lead ports to set climate and clean air goals, which trigger the development of strategies and actions to reduce emissions. However, even motivated ports face significant challenges:

Infrastructure Development: Transmission lines, electric power supply and charging infrastructure are developing too slowly. For instance, the Port of Long Beach has highlighted the need for significant upgrades to the local grid to support their ambitious electrification plans. Without accelerated infrastructure development, including utility, transmission and distribution systems and clean energy resource development, ports will struggle to meet their decarbonisation targets.

Funding Constraints: Public funding is insufficient to achieve ambitious decarbonisation goals. While federal programmes are providing substantial funding, it falls far short of the total investment needed. The Port of Los Angeles has cited the high costs of electrification projects, which exceed available public funds, necessitating additional private investment and innovative financing solutions.

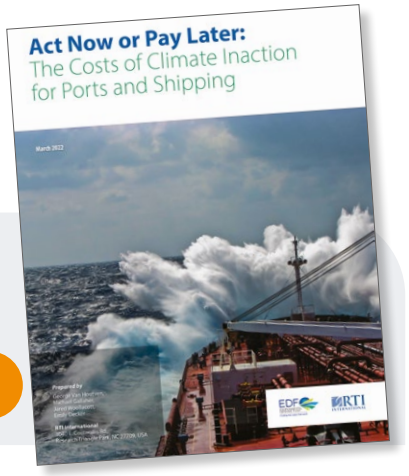
Technological Gaps: While some technologies are ready for deployment at scale (such as electric cargo-handling equipment and shore power systems), many others are in the low- and mid-technology readiness levels. Prototypes and pilot projects like those at the Port of Long Beach (heavy-duty vehicle charging stations) and Port of San Diego (electric tug) are promising, but it will take time to assess scalability potential, including evolving the technologies to address equipment performance constraints. It is critical for ports to deploy market-ready electrification solutions and to host demonstration projects for newer technologies. This dual approach requires a whole-of-supply-chain and government commitment to advancing maritime technology.

Although these challenges are real, they are not insurmountable. By leveraging available tools, fostering collaborative efforts and drawing inspiration from industry leaders, ports can overcome these obstacles and accelerate their electrification journey, paving the way for a climate-positive future.

LEVERAGING RESOURCES AND OPPORTUNITIES

Shore Power Emissions Calculator (SPEC): To address infrastructure development challenges, the U.S. Environmental Protection Agency (EPA) developed this tool to estimate the emissions mitigation potential of shore power systems. The updated Shore Power Emissions Calculator provides accurate data on emissions reduction, supporting ports in their strategic planning and decision-making.

Standardisation, Adaptability & Safety: To overcome technological gaps and barriers to widespread adoption, it is critical that ports consider standardising shore power systems and energy storage



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systems and developing mobile positioning devices for vessel adaptability. These solutions ensure broader adoption and efficiency, facilitating a seamless transition from traditional to electrified equipment. With respect to energy storage, forums like the Maritime Battery Forum provide the industry a dedicated space for developing standardisation and safety practices for new and efficient energy storage technologies.

Allyson Browne

Public-Private Partnerships and Government Grants: Funding constraints can be mitigated through collaborative efforts between public and private sectors. Securing government grants plays a crucial role in funding and implementing electrification projects, and it is critical for ports and industry stakeholders to continue to advocate for federal and state funding for planning and technology development.

Low/Zero-Emission Energy Sources: Integrating low/zero-emission energy sources such as solar and wind power, along with microgrids, charging infrastructure and battery storage systems, addresses both technological gaps and infrastructure development challenges. These integrations can significantly accelerate decarbonisation and enhance energy resilience. The rise of wind power, particularly in California and the Northeast U.S., exemplifies how ports can leverage renewable energy to support their decarbonisation efforts. For example, the Port of Long Beach is pursuing a wind project called Pier Wind, a proposed 400-acre terminal designed to facilitate the assembly of offshore wind turbines, which would be towed to wind farms in the ocean off Central and Northern California. If approved, the proposed Pier Wind project would be the largest facility of its kind in the nation and would help California meet its goals for renewable energy sources. Projects like these require a significant amount of planning, public-private partnership and integrated resource development, and the Port is demonstrating leadership on how ambitious projects like these can be accomplished.

THE URGENCY OF ELECTRIFICATION PLANNING_

Over the next decade, the maritime industry must undergo an unprecedented energy transition to achieve the IMO's goal of carbon neutrality in global shipping by 2050. Ports are at the forefront of this transformation, and the stakes have never been higher. The *Port Electrification Handbook* by PNNL, developed in collaboration with industry leaders, offers comprehensive guidance on electrification projects. The report addresses economic feasibility, resilience impacts and environmental justice considerations. Utilising this Handbook, ports can navigate the complexities of electrification with confidence and clarity, ensuring they are well-equipped to meet the challenges and seize the opportunities ahead.

LEADING BY EXAMPLE_____

PortMiami: PortMiami's proactive capital programme includes initiatives to ensure infrastructure resilience in response to climate change. Their shore power project features an advanced cable management system, switches, remote monitoring and configurations adaptable to various vessel sizes. Helga Sommer, Acting Assistant Director of Capital Development at the port, emphasises, 'Our shore power project exemplifies our commitment to sustainability and climate adaptation, ensuring our facilities can endure the increasing challenges of climate change and continue to serve the community and industry effectively.'

Port of San Diego: With a $4.9 million grant from the California Energy Commission, the Port of San Diego installed a renewable, solar-powered microgrid at the Tenth Avenue Marine Terminal. This microgrid includes battery energy storage and energy efficiency lighting retrofits, providing a resilient power source while reducing greenhouse gas emissions and saving the port approximately 60% annually on electrical utilities.

Port of Virginia: Striving for net-zero carbon by 2040, the Port of Virginia powers all terminals with electricity from clean resources, reducing carbon emissions by 45% per container. It is the first port on the U.S. East Coast to be powered by 100% clean energy, setting a benchmark for other ports.

Port of New York and New Jersey: Implementing science-based Climate Resilience Guidelines, the Port of New York and New Jersey aims to mitigate the effects of climate change on its facilities. The port introduced the first all-electric straddle carrier in the U.S. in 2019 and has committed to achieving net zero carbon emissions by 2050.

A CALL TO PORTS WORLDWIDE_____

The success stories of ports across the U.S. demonstrate that significant progress is achievable with the right strategies and investments. To meet ambitious decarbonisation goals, ports worldwide must begin their comprehensive climate action planning, implementation and development now.

A PRIMER ON CLIMATE ACTION PLANNING FOR PORTS _____

Conduct Comprehensive Baseline Assessments and Resource Planning: Ports must start this process by establishing their baseline emissions inventory across their Scope 1-3 emissions portfolio. Utilise tools like the EPA's shore power emissions calculator to understand emissions mitigation potential and prioritise electrification efforts. This baseline will inform the port's climate action plan (CAP). At this stage, the port should also commence the resource planning process to ensure that utilities/energy supply will be able to meet the port's needs over time.

Develop the Climate Action Plan: Formulate the detailed Climate Action Plan (CAP), which will be the framework to help the port measure, track and reduce GHG emissions, adapt to climate change and make the port more resilient to climate change. The CAP should

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include its mitigation (decarbonisation), adaptation and resilience goals with interim targets, timelines, budgets and key milestones. With respect to electrification, the *PNNL Port Electrification Handbook* offers invaluable guidance for this process. The CAP should consider where and how industry and community stakeholders can contribute to goal achievement and ensure a just and equitable transition. Environmental Defense Fund and Arup's *Practical Pathways for Port Decarbonization and Environmental Justice* offers a series of best practices for net zero-aligned activity and creates measurements for accountability. Specifically, it provides a dashboard with key steps ports can take to help them reach net zero by 2050. Many of these same steps are fundable under the Clean Ports Program, which seeks to reduce air pollution near domestic ports impacting nearby communities. The U.S. EPA also provides a suite of resources for port-wide planning practices to improve air quality, increase port resilience and enhance community-port collaboration.

Identify and Plan Projects: Start with proven technologies and scale up gradually, focusing on high-impact areas such as shore power systems and renewable energy integration. Consider hosting demonstrating projects in collaboration with maritime and blue technology incubators, accelerators and advisory firms.

'It is critical for ports to deploy market-ready electrification solutions and to host demonstration projects for newer technologies'

Secure Funding to Develop Projects: Explore public-private partnerships and apply for government grants to fund electrification projects. For U.S. ports, EPA keeps an up-to-date list of funding opportunities on their website.

Monitor, Evaluate and Adjust: Establish a robust monitoring and evaluation framework to ensure projects meet goals and adapt strategies based on performance data. Ports must strive to provide open and transparent access to data to their customers and their communities for visibility and accountability.

SUSTAINABILITY THROUGH ELECTRIFICATION

The imperative for comprehensive climate action planning, implementation and development is clear. Ports have a unique opportunity to lead the global effort towards sustainability through electrification. By following the strategies outlined here and leveraging available tools and resources, ports can become leaders in climate mitigation, adaptation and resilience. The stakes are high, but with concerted effort and collaboration, the maritime industry can navigate this critical transition successfully, fostering a resilient and sustainable future for all.

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Going off-grid

Dr. Andreas Bodén of PowerCell Group looks at how off-grid energy solutions can help reduce ships' in-port emissions

Due to upcoming legislation pushing the reduction of ships' emissions in ports, the marine industry is facing up to the reality that there is a range of power needs in port that cannot be based upon the existing energy grid, but clean and resilient off-grid energy solutions exist today.

THE SHORE POWER CHALLENGE

Within the European Commission's FuelEU Maritime (FEUM) regulations, as of 2030, it will become an obligation for container and passenger ships greater than or equal to 5,000 gross tonnes (GT) to use shore power supplies for all electricity needs while moored in major European Union ports. There is also growing political pressure in North America and at many of the biggest ports in Southeast Asia to better regulate shipping emissions.

Grid power connections in ports are currently limited and when multiple ships are trying to connect to shore power at the same time it can easily require more power than the grid can offer today. Expanding the capacity and subscriptions for grid power can also take a long time, be costly, and require coordination from various competing stakeholders. Plus, grid power is most often still derived from fossil fuels today.

As a result of the shortcomings of the energy grid for port shore power, ships remain predominantly powered by auxiliary engines when docked in ports to provide energy while the main engines are shut down. Auxiliary engines are typically powered by marine diesel oil (MDO) or marine gasoil (MGO) and are sometimes powered by heavy fuel oil (HFO) in developing countries.

For decades, auxiliary engines have provided reliable energy at a relatively low cost while a vessel is docked. However, they emit significant amounts of local air pollution often near highly populated areas. These include nitrogen oxides (NOx), Sulphur oxides (SOx) and particulate matter (PM) such as black carbon, which negatively impact human health, as well as damaging greenhouse gas (GHG) emissions. Therefore, there is increasing pressure on ports and shipowners to use more sustainable energy sources.

The U.S. Environmental Protection Agency (EPA) estimated that 39 million people in the United States live near ports. Meanwhile, the International Transport Forum (ITF) has also calculated that approximately 230 million people are directly exposed to pollution in the top 100 world ports in terms of shipping emissions.

The Port of Southampton in the UK, for example, has seen a dramatic rise in GHG emissions from cruise ships, according to a recent study from environmental campaign group Transport & Environment (T&E). Cruise ships have high power demands for their hotel operations when in ports, and if they are not plugged into shore power connections, they can heavily pollute the local air while docked.

> 'While fuel cells can be fuel agnostic, hydrogen fuel cells are a strong option for shore power connections as they align well with the hydrogen infrastructure that many ports have planned'

Image © PowerCell Group

Beyond the external societal and regulatory pressures, although there isn't yet a Poseidon Principles for ports, investors and financial institutions are placing increasing weight on sustainability in their decision-making processes. Moreover, many ports are privately owned, which means that there will be pressure at all levels to ensure that they're fulfilling their ESG responsibilities.

At the moment, not enough ports are achieving the desired environmental benchmarks; underinvestment in port modernisation is being recognised at the highest

levels, with the supply chain resilience crisis most recently shining a light on the issue.

Adding to the challenge, climate change is creating higher frequency adverse weather conditions. Hurricanes on the Gulf Coast, for example, have become regular causes of blackouts. Solving this challenge requires power sources that are flexible, reliable, and resilient even in harsh conditions.

Plugging into sustainable shore power connections would solve the major port emissions problem, but the shoreside grid infrastructure and onboard connection equipment are both significantly lacking worldwide. There is a clear need for a solution now while the energy grid capacity and resilience are upgraded and supported by cleaner energy sources.

FUEL CELLS: ELECTRIFY EVERYTHING

Containerised fuel cells provide an interesting burgeoning solution to the shore power challenge. When using green hydrogen as fuel, this solution is truly zero-emission. It produces zero greenhouse gas (GHG) emissions on a full lifecycle basis. Fuel cells can also use all other e-fuels with reformer technology and still achieve strong emissions savings.

While fuel cells can be fuel agnostic, hydrogen fuel cells are a strong option for shore power connections as they align well with the hydrogen infrastructure that many ports have planned, such as The Port of Rotterdam's hydrogen backbone, as well as wider government planning for hydrogen supply-side infrastructure.

Shore power requires an onshore power connection and ships that can connect to this power source. Consistent and interoperable electrified infrastructure onboard and onshore is key to success. For this reason, shore power is most feasible right now for point-to-point connections, such as ferries, container lines and Ro/Ro-ships. These vessels, representing about 15% of marine GHG emissions, are also ready to be decarbonised via fuel cells. As a result, fuel cells can offer the opportunity for aligned and consistent electrified infrastructure.

Fuel cells also offer an independent 'off-grid' clean energy source. They add a layer of resilience if, for example, the grid is unstable or goes down, and they can stabilise power supplies during peak times of demand. By supporting this 'peak shaving' they can also lower ports' energy costs.

PowerCell Group and Hitachi Energy have recently developed a new containerised hydrogen fuel cell solution called Hyflex™. Together with Skanska, Port of Gothenburg and Linde Gas, they collaborated on a demonstration in the Port of Gothenburg in March 2024.

The Hyflex™ power unit is currently focused on off-grid power generation for construction sites but also has port and marine applications. It uses a 100kW hydrogen fuel cell combined with batteries to generate off-grid power, but this can be scaled up to 1MW.

The total addressable market for a flexible port shore power solution is huge. The Port of Rotterdam Authority has calculated that the total energy demand and consumption of sea-going vessels at its berths – the world's tenth busiest port – amounts to approximately 750-850GWh (equivalent to 250,000 households) each year.

With FEUM shore power legislation fast approaching and increased societal and investor scrutiny on port emissions, it is time to electrify onboard and shoreside marine infrastructure via fuel cells. Any technologies that can act as either a stopgap while grid infrastructure is developed, support the grid at peak times or during periods of instability, or indeed become a permanent flexible energy option in ports should be embraced. There is a new generation of mature fuel cell technology available today that is ready to support regulatory compliance and tackle the port emissions crisis.

Dr. Andreas Bodén

Image © PowerCell Group

'The total addressable market for a flexible port shore power solution is huge'

Dr. Andreas Bodén,
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Fuel cost parity

Sustainable fuels will be key in supporting the shipping industry's ambition to achieve net-zero by mid-century. **Toni Stojcevski** of Wärtsilä Marine examines how coordinated action across policymakers, industry and individual operators will bring about the broad system change required to fuel the energy transition

To reach the critical mass required to decarbonise the shipping industry by 2050, it's clear there is a need to rapidly scale up the supply of sustainable fuels.

With the engine technology already available, the next steps rely on building certainty and consensus around which fuels will become the most widely available and financially sustainable options in the decades to come. To achieve this, both policy and coordinated action are needed to drive investment in the required production, storage and supply infrastructure.

THE SCALE OF THE CHALLENGE

According to United Nations Trade and Development's (UNCTAD) most recent Review of Maritime Transport, to fully decarbonise by 2050, the shipping industry will need around 270 million tonnes of the heavy fuel oil equivalent of alternative fuels. As well as scaling-up supply of these fuels, investment in fuel infrastructure is an essential next step.

In total, according to Clarksons data, if we are to reach net zero by 2050, this will cost the shipping industry around $5 trillion in newbuilding and equipment upgrades for renewal of the global fleet. DNV calculates that $8 billion to $28 billion a year must be spent on ships and between $28 billion and $90 billion a year to scale up production, fuel distri-

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bution and bunkering infrastructure to supply the totality of carbon neutral fuels by 2050.

To drive this investment, policies such as carbon taxes and emission limits should be implemented to send a demand signal to industry, investors and operators. Not only will this strengthen cost-parity between conventional and sustainable fuels, but the revenues generated from carbon pricing can be reinvested into the maritime sector to support innovation and the development of sustainable fuel solutions and infrastructure.

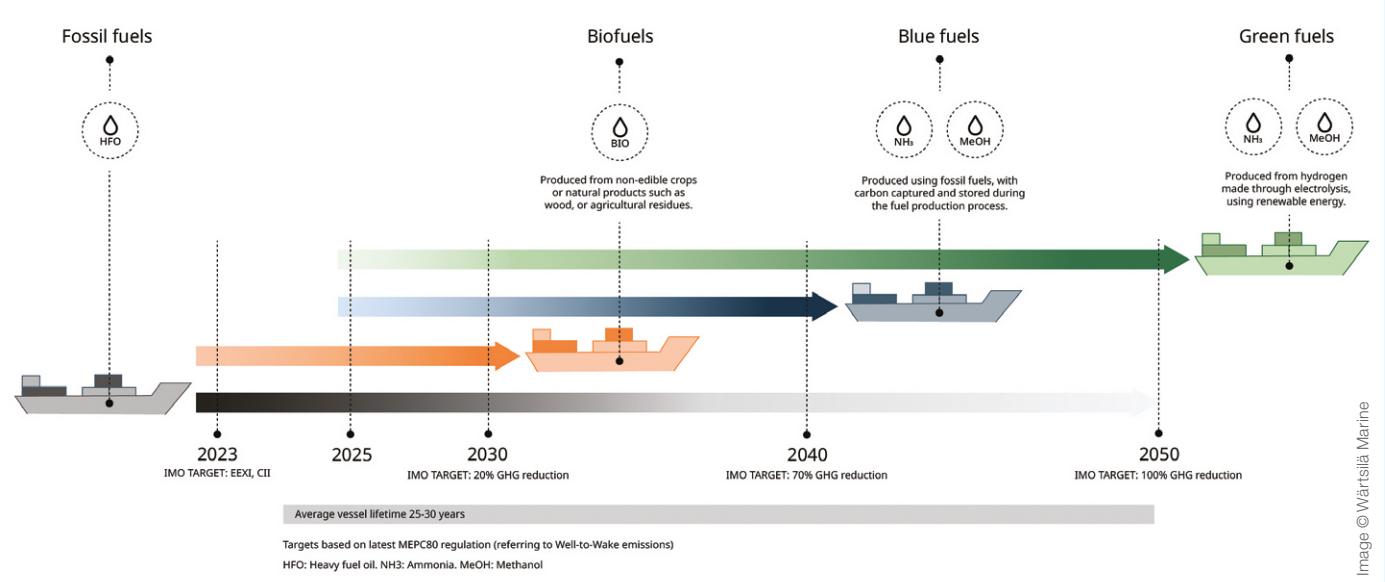
COST PARITY LIKELY BY 2035

A picture of where investment can be channelled is already emerging. As detailed in our recent report *Sustainable Fuels for Shipping by 2050 – the 3 Key Elements of Success*, LNG is likely to act as a transition fuel, followed by biofuels in the 2030s. 'Blue' fuels including blue ammonia and methanol – derived from fossil fuels but with carbon capture – will then act as bridging fuels. 'Green' synthetic fuels produced using renewable energy are predicted to then become widely available at scale by the late 2030s and early 2040s.

Ammonia and methanol are emerging as the frontrunners for post-2030 and, while more expensive today, are already likely to achieve cost parity with conventional bunker fuels as early as 2035 as a result of the introduction of stringent regulations such as the EU Emissions Trading Scheme (ETS) and the FuelEU Maritime Initiative (FEUM).

Based on public EU MRV data, the total emissions subject to EU ETS in 2022 was about 90.4 million tonnes. Assuming these remain at the same level and a EUA price of €90 per tonne of CO_2 in 2024 and €100 per tonne in 2026, this could cost shipping €3.3 billion in 2024, rising to €9 billion in 2026. Accordingly, at an EUA price of €90, ship operators can save about €270 for every tonne of fuel saved (as 1 tonne of marine fuel oil emits roughly 3 tonnes of CO_2).

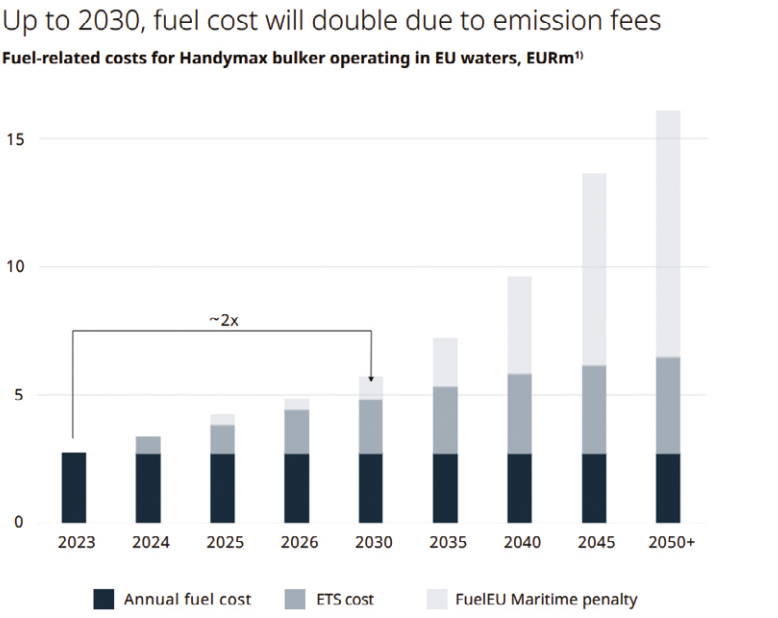
In addition, from 2025, FEUM will increase the demand for renewable and low-carbon fuels in the EU. FEUM sets GHG emission intensity requirements on ships trading in the EU from 2025 and mandates the use of shore power for container and cruise ships in certain EU ports from 2030. Over time, FEUM is expected to have an even larger impact than the EU ETS. It's important to



Wärtsilä analysis shows EU ETS and FuelEU Maritime will close the price gap, creating a policy blueprint to accelerate the global transition to sustainable fuels

point out that these regulations are limited to vessels operating in European waters.

The adoption of a global industry standard for marine fuel carbon pricing would enhance the cost competitiveness of sustainable fuels even further by creating a level playing field where carbon-intensive fuels incur higher costs worldwide. However, because global regulations can often take longer to implement, for various reasons, it is important that any global regulations are supplemented by local regulations which can be implemented at speed, in order for shipping to fully support the industry's decarbonisation targets.



Up to 2030, fuel cost will double due to emission fees. Fuel-related costs for Handymax bulker operating in EU waters

> 'The infrastructure required to support ammonia and methanol as marine fuels can be integrated into existing systems with relatively minor modifications to the engines'

THE OPERATIONAL CONSIDERATIONS

While cost is a major factor from a commercial perspective, the operational realities of storage and bunkering are important to consider. Let's take ammonia and methanol as examples. Both ammonia and methanol can be stored and handled more easily compared to other alternative fuels like hydrogen. Ammonia, for instance, does not require cryogenic storage and biogenic CO_2 is not needed for the production of green ammonia. Methanol, on the other hand, can be stored as a liquid at ambient temperatures, simplifying storage and bunkering processes.

It is also important to talk about the space needed onboard a ship for the required endurance. Space on a ship is always optimised for maximum cargo or passengers. For methanol, the space needed is close to two times more compared to conventional fuels, and for ammonia it is almost four times. This is still an acceptable compromise to decarbonise shipping. For hydrogen, however, the space needed is close to 20 times for compressed hydrogen.

Another key reason that ammonia and methanol are emerging as the most likely future fuels is that the infrastructure required to support ammonia and methanol as marine fuels can be integrated into existing systems with relatively minor modifications to the engines.

Wärtsilä is committed to developing fuel flexible engines and supply solutions to support the real-world viability of ammonia and methanol. In addition to our wide portfolio of methanol-ready engines, last year in 2023, Wärtsilä announced the world's first 4-stroke engine solution for ammonia fuel, capable of reducing greenhouse gas emissions by more than 70%. As technology continues to be developed, these practical operational challenges are becoming much less of a hurdle.

CROSS-INDUSTRY COLLABORATION

Even with proven technologies and more decisive global and local policies, the transition to cleaner fuels will also require industry collaboration and individual operator actions. Coordinated efforts across the maritime sector will be essential to scale the production of sustainable fuels and develop the necessary infrastructure to support widespread adoption along green corridors globally.

For example, pooling buying power through sector-wide procurement agreements can combine demand from multiple operators, providing a stronger market signal for sustainable fuel producers. This collective approach can reduce the cost of sustainable fuels by ensuring steady demand and enabling economies of scale.

Individual operators also, of course, have a vital role to play in taking action. Investing in fuel flexibility technologies (fuel-flexible engine solutions), for example, is one way for individual operators to ensure they are operating more efficiently, whilst, at the same time, benefit from better chartering contracts by being among the first to implement these types of sustainable solutions.

Dual-fuel engines available today that can run on both sustainable and conventional fuels provide owners and operators with the ability to future-proof their vessels against future regulatory and market changes. Wärtsilä's development of multiple-fuel-capable engines, including the Wärtsilä 25 platform, which can be adapted to run on diesel, LNG, biofuels, and ammonia, allows operators to utilise whichever fuel is available at ports across the world while infrastructure continues to grow.

Importantly, we should not forget that bunkering supply infrastructure and storage facilities should be encouraged to invest and will be more inclined to do so as industry signals its intentions – through collaboration, through investment in future-fuel capable engine platforms and through supporting policy interventions. This cross-industry collaboration will ensure that every link in the maritime value chain can move in-step towards achieving net-zero.

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Power of cooperation

Spinergie's **Hugo Madeline** and **Sarah McLean** argue that the maritime sector will need cohesion to successfully implement carbon-neutral fuels

The maritime industry is making steady progress toward emission reduction goals, but significant challenges lie on the path to net zero by or around 2050 – and the need to reach this ambitious goal is clearer than ever.

So, what is the situation as it stands today, and what is the clearest path ahead to meeting emissions targets?

REGIONAL MOVES TOWARDS REDUCED EMISSIONS

In early July 2023, the Marine Environment Protection Committee 80 (MEPC 80) session closed on a historic agreement to reach net zero by 2050. The agreement aims to develop three main initiatives: improving the Carbon Intensity Indicator (CII), reducing the carbon content of fuels, and meeting net zero by 2050. In tandem, several regional movements have emerged to support the common goal.

The European Union (EU) has taken the most steps of any regional body to meet carbon reduction goals in shipping. In a groundbreaking move, it was decided that shipping companies would be required to pay for emissions under the EU Emissions Trading System (EU ETS) from 2024 onwards. In parallel, the EU is introducing the FuelEU Maritime (FEUM) directive, which obliges vessels above 5,000 GT that call at European ports to reduce the greenhouse gas (GHG) intensity of the energy used onboard.

While it may be the most advanced in the emissions reduction process, Europe is not alone. In the USA, the Clean Shipping Act, expected to become an amendment to the U.S. Clean Air Act, is currently under discussion. The bill was introduced in June 2023 to direct the Environmental Protection Agency (EPA) to set stricter carbon intensity standards for shipping fuel. Meanwhile, in Brazil, discussions are ongoing to develop a carbon market that potentially includes maritime emissions.

These regulations focus on the shipping industry, while the offshore industry is not yet included. This is mainly due to the latter's inherent work-based function, unlike the voyage-based shipping industry, which involves transporting goods and passengers. The offshore fleet comprises various high-level activity modes: at port, standby offshore, working offshore (on DP, jacked Up, …), and in transit.

HOW TO MAKE THOSE CRUCIAL EMISSIONS REDUCTIONS

So we see that initiatives are in place, to varying degrees, at a global and regional level. But just how are maritime industry players expected to meet these new lower emissions targets? To date, three main categories have emerged: operational efficiency, new onboard technologies, and alternative fuels.

Improving operational efficiency within the fleet is key, and digitalisation is an important component. By utilising a digital fleet management system, vessel owners benefit from better marine coordination, weather routing, and fuel consumption benchmarking, which are considered short-term measures to reduce fuel consumption from 5 to 15%.

A medium-term solution is to implement equipment upgrades that specifically reduce fuel consumption. These upgrades can include hybrid electric systems with energy battery onboards (from 10 to 15% reduction) or wind-assisted propulsion.

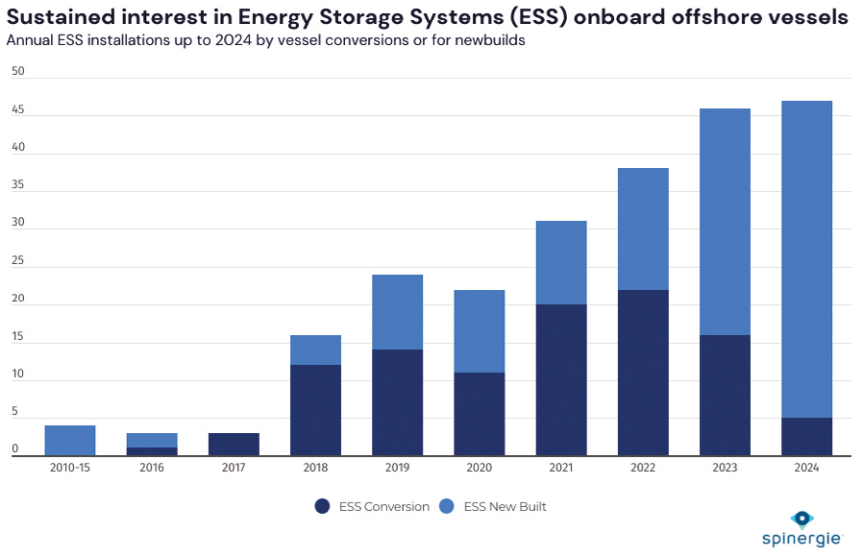
Finally, and perhaps the most effective driver of emission reduction, albeit the least mature, is using carbon-neutral[1] fuels. Of course, using such fuels relies heavily upon a strong supply chain and collaboration with all players, so it is not without barriers.

The shipping and offshore industries are currently exploring alternative fuels amidst growing demand. Within the offshore industry, 150 vessels are recorded as dual-fuel capable to date. But with this method being the least mature, alternative fuels are also

> 'There is a real industry-wide necessity for further training pertaining to the use of alternative fuels. In particular, training is required to assess the operational readiness of crews during incidents or accidents'

Image © Spinergie

Hugo Madeline



An example of how the adoption of energy storage systems (ESS) has progressed in the offshore market with a significant increase in their use since 2018

The Main Shore Power Facilities in Northern Europe as indexed by Spinergie Market Intelligence

the centre of many debates surrounding the most effective emission reduction measures.

WHY ARE ALTERNATIVE FUELS SO IMPORTANT?

The shipping industry consumes more than 320 million tonnes of fuel[2], while offshore vessels consume 7 million tonnes[3] yearly. Combined, they represent 3% of global GHG emissions. As of today, over 99% of the maritime industry uses fossil-based fuels with minimal opportunities for alternative options. While some vessel owners have moved towards LNG, a fossil-based marine fuel, adopting this technology took a setback due to price increases that followed Russia's invasion of Ukraine.

In the medium term, the maritime industry is looking towards biofuel, which offers a good opportunity to reduce overall carbon content while also benefitting from clear sourcing. Biofuel production is competitive in multiple industries, namely the farming industry, which impacts land use, and the aviation industry, which sees this fuel type as a solution to reduce emissions.

In the longer term, an uptake of carbon-neutral fuels will occur with e-fuels expected to be key in achieving the global transition. While there are still numerous hurdles to overcome, from production to regulatory framework, when renewable sources are used in e-fuel production, up to 90% GHG reduction is achieved compared to when gasoil is used.

MAJOR ROADBLOCKS AND INITIATIVES IN ALTERNATIVE FUELS – THE 'INFINITE LOOP'

Numerous roadblocks face maritime stakeholders as they adopt alternative fuels. Each aspect of this 'infinite loop' has knock-on effects for the others, hampering progress. But promisingly, initiatives are underway.

As seen before, international and regional regulations are coming into force to push vessel owners and contractors into considering emission reduction measures.

On a larger scale, stakeholders are considering introducing green corridors: routes from one port to another where reduced emissions are imposed, including using alternative fuels. As of 2024, more than 57 announcements have been made, with the longest green corridor being from Singapore to Rotterdam.

Furthermore, guidelines and standards are being developed for alternative fuels to ensure they comply with safety and regulatory requirements. Classification societies are

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actively developing new guidelines and safety assessments to promote the usage of new fuels, while new class notations have been introduced to provide shipowners with flexibility in preparing future retrofitting programmes.

Looking at the offshore market, Fortescue's *FFI Green Pioneer* is the world's first Platform Supply Vessel retrofitted with ammonia-capable engines. Fortescue worked closely with DNV on the technical assessment and approval of the vessel's ammonia safety design under the SOLAS alternative design and arrangement regulation. The vessel received the 'Gas-fuelled Ammonia' certification. Nonetheless, it still faces port restrictions that prevent it from using ammonia in port boundaries for safety reasons.

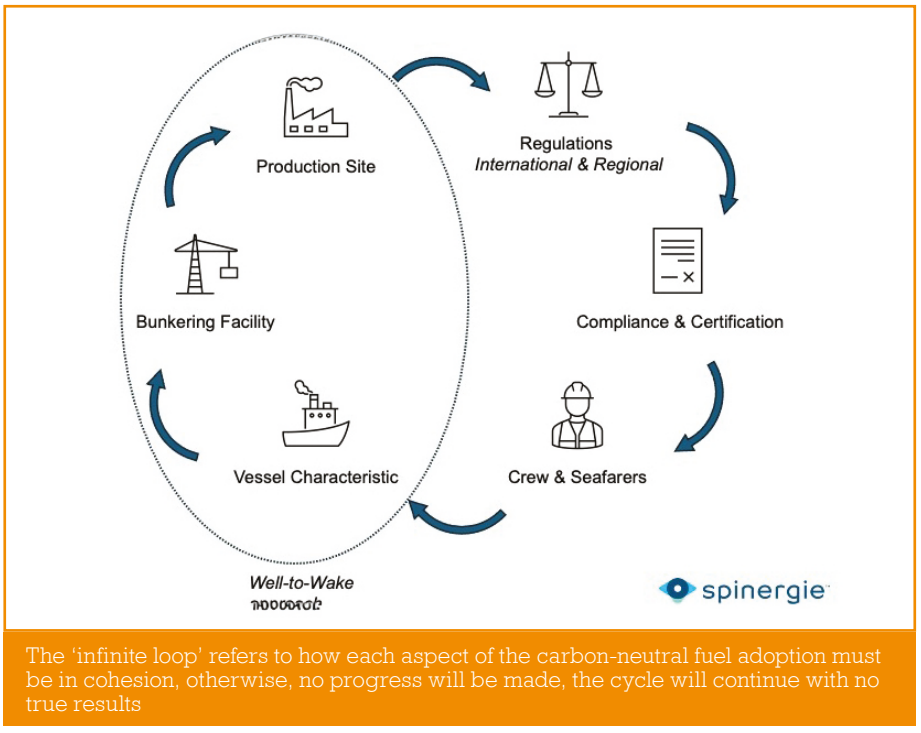
Indeed, further safety considerations must be considered with seafarers at the forefront. There is a real industry-wide necessity for further training pertaining to the use of alternative fuels. In particular, training is required to assess the operational readiness of crews during incidents or accidents.

Beyond safety, infrastructure and production are important components of the loop. Port infrastructures are well-positioned to set new standards for green fuels by setting up bunkering facilities or even shore power connection systems to allow vessels to shut down their engines while at the quay. However, it's important to note that the main electricity grid must also be able to support the charge.

Production must also scale up to meet future demand. Here's a further example. In 2023, Maersk announced a partnership with Equinor, securing green methanol supply for the newest methanol-fuelled container ship, *LAURA MAERSK*. This biomethanol fuel, made from manure-derived biogas, is ISCC EU certified per the EU Renewable Energy Directive. However, more such partnerships will be key in progressing this technology further.

Vessel owners can also further consider how upgrades to the existing fleet and newbuild designs will integrate new engine capabilities to better cope with future fuels. As of July 2024, 157 offshore vessels are equipped with shore power connection systems and 117 have been announced as dual fuel capable with carbon-neutral alternatives (ammonia, hydrogen, or methanol).

Each step in the well-to-wake approach – that is, the entire process of fuel production for use onboard ships – is essential and must be considered equally. Availability is of the utmost importance – from the production site to the bunkering facility – otherwise, the entire value chain is in question. Vessel owners must also be able to trust that they will secure fuel deliveries during the fuel supply chain to ensure the viability of this technology. Addressing each stage of the loop to ensure cohesion is crucial.



The 'infinite loop' refers to how each aspect of the carbon-neutral fuel adoption must be in cohesion, otherwise, no progress will be made, the cycle will continue with no true results

CLOSING THE LOOP

Centralising production and demand efficiently reduces entry barriers, including costs. As a final example, we can look to Norway to see how industry players work together at a regional level. In Norway, the government provides grants and support for green shipping projects and technologies. The latest round allocated NOK 1.2 billion to 15 projects for ammonia and hydrogen projects. Meanwhile, Rem Offshore, Eidesvik, and Agalas are investing in (at least) two new methanol-fuelled construction vessels.

Further Norwegian initiatives include supporting the development and testing of zero- and low-emission technologies, promoting the use of electric ferries in public transportation systems, and announcing that cruise ships must operate with zero emissions in World Heritage Fjords from 2026. These initiatives not only demonstrate Norway's commitment to promoting carbon-neutral fuels and green technologies in the maritime industry but showcase how a combination of regulatory measures, financial incentives, research support, and international collaboration is optimum.

We have seen that many initiatives are either in place or forthcoming that are helping work towards a more sustainable future. Alternative fuels are a key component of this future. But it is also clear that all industry players, from regulators to ship owners, contractors, and port authorities, must collaborate to achieve this and reduce the related costs. All have a part to play in ensuring their part of the 'infinite loop' is compatible with others, so challenges become clearer and more achievable.

1. Fuels that result in vessels producing very low or no GHG emissions from well to wake, including renewably produced Methanol, Ammonia, Hydrogen, and biofuel.
2. According to IMO GHG Study 2020
3. Spinergie Offshore Emissions Model 2023 (excl. Offshore rigs, FPSOs, dredgers, and tugs)

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From production to propulsion

Environmental Defense Fund's **Natacha Stamatiou** champions the case for using a Well-to-Wake approach to regulating shipping's emissions

In early June, I attended the Posidonia shipping exhibition in Athens, Greece. Over the years, this event has increasingly centered on crucial topics such as the energy transition of shipping, ship energy efficiency, and decarbonisation solutions. Given Greece's prominence in global shipping, numerous Greek ship owners were present to discuss the impacts of decarbonisation on their operations. Generally, their strategies could be characterised as cautiously pragmatic, with investments primarily in LNG, a few orders for methanol-ready ships, and a prevalent 'wait and see' approach. Although this conservative stance was noticeable, what was even more striking was the absence of discussions on the lifecycle assessment (LCA) of fuels. It is interesting seeing this oversight as we approach the 82nd Marine Environment Protection Committee (MEPC 82) meeting at the International Maritime Organization (IMO) in September, where the discussions around the LCA of fuels are meant to take place.

The IMO has been actively working on new regulations to reduce emissions from ships and is adopting a phased approach to contribute to global efforts to combat climate change. Last year's revised Strategy on Reduction of Greenhouse Gas (GHG) Emissions from Ships committed the shipping sector to reduce their emissions by at least 20% by 2030 and at least 70% by 2040, while accounting for the sector's climate footprint on well-to-wake (WtW) basis, also known as cradle to grave – an LCA approach that covers the entire lifecycle of the fuels, including combustion, where applicable. However, it is the IMO's Basket of Measures that will deliver the promised savings, and only a well-designed LCA framework will be able to propel the shipping sector where it needs to be in terms of decarbonisation by funnelling resources to truly sustainable fuels.

The IMO has an important role to play and can help establish a global framework where emissions from the production and use of marine fuels are tracked comprehensively and without overlap, with uniform guidelines on how to calculate and report emissions for each stage of the fuel lifecycle, irrespective of the geographical location of those activities.

Such an approach ensures that, in addition to combustion emissions, upstream fuel production emissions are considered. The adoption of a scientifically robust WtW approach therefore helps promote truly sustainable fuels for their environmental and societal benefits, as significant emissions reductions of sustainable fuels can occur upstream as well as at combustion.

> 'Only a well-designed LCA framework will be able to propel the shipping sector where it needs to be in terms of decarbonisation by funnelling resources to truly sustainable fuels'

THE NEED FOR A WELL-TO-WAKE APPROACH

In the context of maritime shipping, the WtW approach provides a comprehensive method for assessing the GHG emissions of marine fuels by evaluating their total environmental impact from extraction ('well') to combustion ('wake'). Such analysis offers a holistic view of the emissions throughout the entire fuel lifecycle, including extraction, production, transportation, storage and use.

The final phase of a fuel – combustion within the ship's engine – often receives the most attention because it is directly linked to ship's operational emissions. This process releases not only carbon dioxide but also other harmful emissions such as methane (CH_4), nitrous, nitrogen and sulphur oxides (N2O, NOx and SOx), and particulate matter. However, the alternative fuels at hand will have similar combustion emissions and most of the disparity will happen upstream, hence the need for a full lifecycle assessment.

Indeed, the WtW approach is essential for providing a more accurate depiction of the environmental and social impacts associated with the production of alternative maritime shipping fuels. Such thorough analysis is crucial for regulators, ship operators, and the industry at large to make informed decisions about fuel choices and to implement strategies that effectively reduce environmental impacts, rather than merely shifting emissions from one sector to another. It also matters to some cargo owners who have pledged to clean up their supply chain and will rely on a robust LCA framework. This is particularly relevant as the industry explores alternative fuels like LNG, methanol, ammonia, and biofuels, each with distinct production, processing, and utilisation emissions profiles.

Let's take LNG as an example, promoted by industry stakeholders as a key opportunity to decarbonise shipping. From that point of view, the main benefit of fossil LNG is that it leads to between 20% and 30% lower CO_2 emissions at the combustion stage compared to conventional oil-based fuels. However, its overall GHG footprint – including methane leakage during natural gas extraction, distribution, and liquefaction, as well as meth-

ane slip at the engine stage – is likely to negate these benefits. Even small methane leaks could result in large climate impacts. Methane has more than 80 times the warming power of carbon dioxide over the first 20 years after it reaches the atmosphere. Even though CO_2 has a much longer-lasting effect, methane sets the pace for warming in the near term. And whether we like it or not, climate change has truly become a near-term issue.

is not to exclude any particular pathway or feedstock, but to put in place an objective framework to compare climate impacts of marine fuels and ensure all fuels compete on equal footing based on their sustainability attributes. Practically, it will also help penalise or incentivise the uptake of certain fuels based on their true climate performance.

Similarly, biofuels might seem like an ideal sustainable alternative as they are derived from biological materials and can reduce dependency on fossil fuels. However, considering the WtW perspective, the sustainability of biofuels must also account for the land use change, potential deforestation, and water use. If we also consider other industries' increasing demand on sustainable biomass, the scalability of advanced biofuels for shipping is likely to come up to hard limits. By embracing the WtW approach, the maritime industry will be equipped to make more informed decisions, ensuring that strategies for emission reduction address the full spectrum of environmental and social impacts and drive genuine progress towards sustainability.

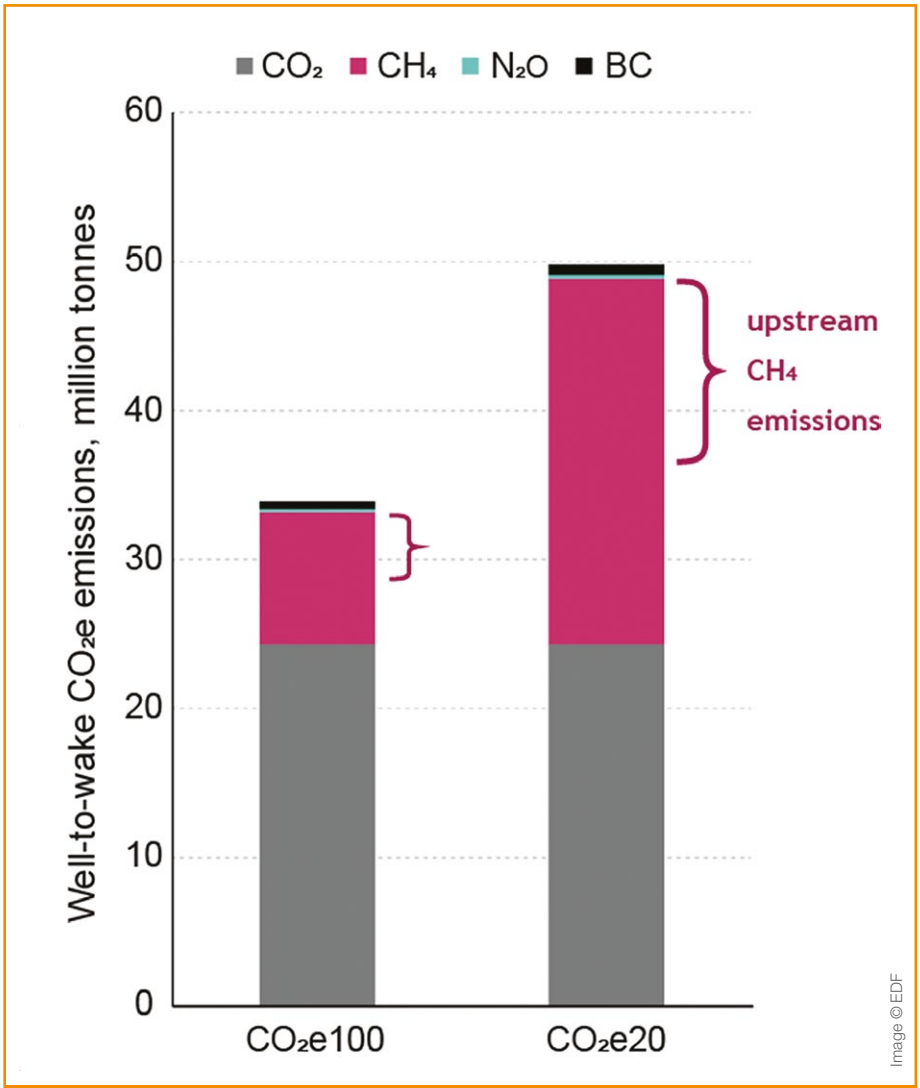

Figure 1: Modified ICCT graph of estimated well-to-wake CO_2e emissions from LNG-fueled ships trading with the European Union

Figure 1 shows why a WtW accounting of emissions is crucial. Upstream methane leakage (covered by the brackets) is in most cases almost as significant as methane slip which happens at the engine stage (part of the column in red not covered by the bracket).

LNG is a familiar example that helps to illustrate upstream emissions risks, but in reality, harmful emissions can also result from all alternative fuels. This extends in varying degrees to grey and blue ammonia, hydrogen and methanol. The rationale of a scientifically robust LCA approach

BENEFITS OF WELL-TO-WAKE

The European Union's Renewable Energy Directive (RED II) sets a requirement that new alternative fuels must achieve at least a 70% reduction in GHG emissions compared to conventional fossil fuels on a lifecycle basis (which are set at 94 gCO_2eq/MJ, meaning that alternative fuels should have GHG emissions of no more than 28.2 gCO_2eq/MJ to meet the required reduction threshold). A WtW framework is pivotal in identifying truly sustainable fuels that can offer such reductions in GHG emissions across their entire lifecycle. It offers a crucially more comprehensive framework for evaluating marine fuel emissions compared to Tank-to-Wake (TtW) or Well-to-Tank (WtT) analyses. Each of these methodologies focuses on different segments of the fuel lifecycle, leading to variations in their assessments and potentially misleading perceptions of sustainability.

A robust LCA approach forms a solid foundation for decarbonisation policies, such as the Mid-Term Measures currently in development at the IMO. While one strategy focuses on WtW emissions, other proposals align more with the IMO's traditional emphasis on ship-level emissions. The basic TtW approach could, in theory, be modified within a sustainability framework but is unlikely to fully account for upstream and midstream emissions, potentially leading to misguided incentives in mechanisms like GHG pricing or fuel standards. For instance, a TtW Global Fuel Intensity (GFI) rule might permit compliance using grey ammonia – a fossil-based product that neither uses renewable energy nor demands significant new investments. In contrast, a strategy that prices GHG effectively and sets a fuel standard based on WtW emissions could encourage the use of green e-ammonia, produced with renewable power – aligning better with environmental goals.

DOUBLE COUNTING IN EMISSIONS ACCOUNTING

Some member states and stakeholders express concerns about double counting within the WtW approach due to the comprehensive scope it entails – spanning from fuel production to final combustion. The fear is that the same emissions might be accounted for multiple times in each segment of the supply chain, especially in international contexts where fuels are produced in one country and consumed in another. These concerns are par-

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'Resolving potential issues of double claiming between the IMO and the Paris Agreement can be straightforward once a clear distinction is made between inventory reports and the indicators tracking climate goals under either framework'

Image © EDF

Natacha Stamatiou

ticularly acute when considering international maritime operations, where cross-border fuel transfers and diverse regulatory environments complicate emissions tracking. WtW assessments account for emissions reductions and removals, which are also included in the national inventory reports of Parties to the Paris Agreement. Without transparency and proper action by these Parties and the IMO, there's a risk that these reductions could be claimed more than once for different climate goals, compromising the integrity of IMO actions and global climate ambitions.

Resolving potential issues of double claiming between the IMO and the Paris Agreement can be straightforward once a clear distinction is made between inventory reports and the indicators tracking climate goals under either framework. This process requires Parties to the Paris Agreement to authorise, report, and account for any emissions reductions and removals associated with maritime alternative fuels under their jurisdiction, following Paris Agreement guidance (Art. 6 for internationally transferred mitigation outcomes). Additionally, these countries need to make a 'corresponding adjustment' to their Emissions Balances as per the transparency guidelines outlined in Art. 13 of the Paris Agreement, determined by the mitigation outcome claimed under the lifecycle assessment.

However, the responsibility doesn't solely rest with the Parties to the Paris Agreement. They require timely access to information on the characteristics and usage of maritime alternative fuels to fulfill their reporting and accounting obligations under Arts. 6 and 13, and for the international bunkers themselves. Here, the IMO plays a vital role in establishing a transparent and robust system for accounting and reporting emissions in international shipping.

CONCLUSION

Reflecting on my experiences at the Posidonia exhibition earlier this year underscores the ongoing transformation in the maritime industry. I am optimistic that future editions of the conference will delve deeper into the critical issues of energy transition, showcasing more forward-thinking discussions that mirror the evolving regulations and the urgent need for a comprehensive view on fuel impacts. This evolution in dialogue will not only align with global sustainability efforts but also inspire industry leaders to adopt more ambitious environmental strategies, setting a precedent for the entire sector.

Implementing a robust WtW approach with strong international fuel standards and collaboration not only prevents double counting, but also enhances the global maritime industry's ability to assess and manage its environmental impact. This unified approach ensures that all stakeholders – from fuel producers to shipping companies – have a clear understanding of their emissions profiles, contributing to more effective global strategies for emission reductions and alternative fuel adoption.

As the maritime industry advances towards this approach, embracing a harmonised framework akin to the one adopted for international aviation by the International Civil Aviation Organization (ICAO) could streamline regulations and strengthen the global response to maritime emissions. The IMO's role in aligning international maritime practices with proven aviation strategies will be critical in managing environmental impacts, fostering sustainability in global shipping, and tapping on alternative fuel production synergies between shipping and aviation.

Moreover, a standardised approach not only encourages investment in cleaner technologies and fuels—ensuring global compliance and stimulating innovation—but also enhances transparency and accountability, which are crucial for tracking progress towards international climate goals. Embracing a full lifecycle assessment is essential for first movers in the maritime industry, providing a deep understanding of the environmental impacts of fuels from production to end use. This knowledge is vital for making informed, strategically sound fuel choices that are economically and environmentally responsible.

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The law of the sea

Opportunity Green's **Isabela Keuschnigg** outlines the importance of the recent advisory opinion from the International Tribunal for the Law of the Sea and explains how it will impact global shipping

In May this year, the International Tribunal for the Law of the Sea (ITLOS) caused a ripple across the international law community when it handed down a historic advisory opinion on climate change and the marine environment.

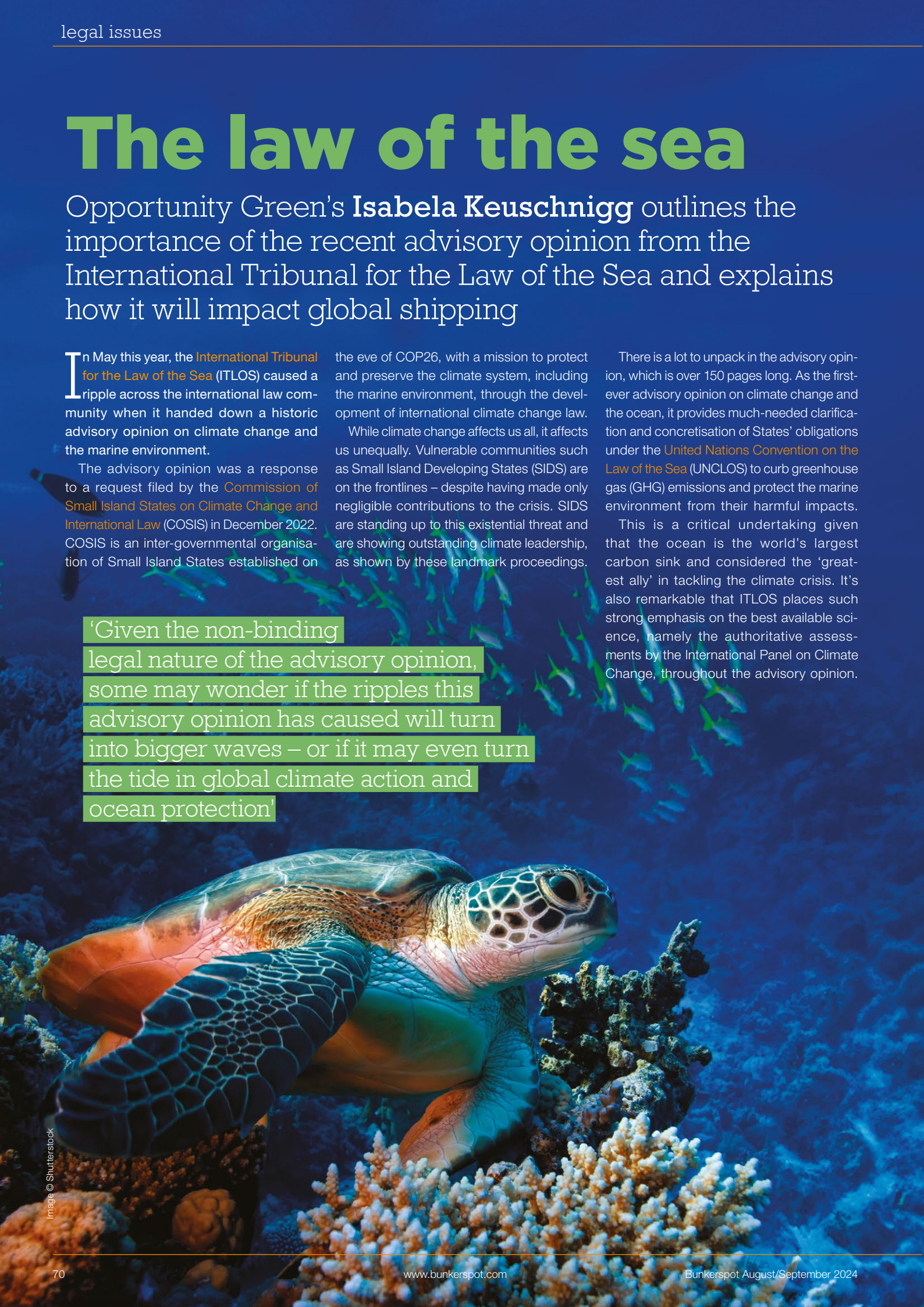
The advisory opinion was a response to a request filed by the Commission of Small Island States on Climate Change and International Law (COSIS) in December 2022. COSIS is an inter-governmental organisation of Small Island States established on the eve of COP26, with a mission to protect and preserve the climate system, including the marine environment, through the development of international climate change law.

While climate change affects us all, it affects us unequally. Vulnerable communities such as Small Island Developing States (SIDS) are on the frontlines – despite having made only negligible contributions to the crisis. SIDS are standing up to this existential threat and are showing outstanding climate leadership, as shown by these landmark proceedings.

There is a lot to unpack in the advisory opinion, which is over 150 pages long. As the first-ever advisory opinion on climate change and the ocean, it provides much-needed clarification and concretisation of States' obligations under the United Nations Convention on the Law of the Sea (UNCLOS) to curb greenhouse gas (GHG) emissions and protect the marine environment from their harmful impacts.

This is a critical undertaking given that the ocean is the world's largest carbon sink and considered the 'greatest ally' in tackling the climate crisis. It's also remarkable that ITLOS places such strong emphasis on the best available science, namely the authoritative assessments by the International Panel on Climate Change, throughout the advisory opinion.

'Given the non-binding legal nature of the advisory opinion, some may wonder if the ripples this advisory opinion has caused will turn into bigger waves – or if it may even turn the tide in global climate action and ocean protection'



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THE MAIN OUTCOMES OF THE ITLOS ADVISORY OPINION

The outcomes of the opinion are highly significant for international climate change law, and a historic marker for small island states. Key findings of the advisory opinion include:

- The Tribunal unanimously found it had jurisdiction and exercised its discretion to issue the advisory opinion. This alone is a significant step and a credit to COSIS and their legal advisors who worked on the request.
- The Tribunal referred to the authoritative scientific assessments of the Intergovernmental Panel on Climate Change (IPCC) – noting the drastic impacts of climate change on the ocean and that 'climate change represents an existential threat and raises human rights concerns'.
- Human-caused greenhouse gas (GHG) emissions fall within the definition of 'pollution of the marine environment' and therefore States are subject to a wide-ranging set of obligations under UNCLOS to address GHG emissions.
- States, individually or jointly, should take 'all necessary measures' to prevent, reduce and control GHG emissions from any source. This is a stringent standard of due diligence, informed by the best available science and the 1.5°C temperature goal in particular.
- States cannot necessarily discharge this obligation exclusively through participating in global efforts – States are also required to take individual actions as appropriate.
- Obligations under UNCLOS are not satisfied simply by complying with the Paris Agreement.
- States must also take 'all necessary measures' to ensure that GHG emissions under their jurisdiction or control do not cause damage to other States and their environment. ITLOS interpreted 'jurisdiction or control' broadly (going beyond a State's territory and encompassing its exclusive economic zone and continental shelf), encompassing public and private actors and gave as an example activities carried out on board ships or aircraft which are registered in that state.
- A failure to comply with the obligation to take all necessary measures to mitigate GHG emissions engages international responsibility for the State in breach, leaving open the door to potential legal remedies and compensation.
- States with greater capabilities must do more than States with less capabilities, and there are extensive obligations on States to cooperate and to provide assistance to developing States.
- The obligation to protect and preserve the marine environment extends to adaptation and restoration.

ITLOS' CONSIDERATIONS ON SHIPPING OBLIGATIONS

At Opportunity Green we were particularly interested in reading ITLOS' considerations on shipping obligations as we had submitted a supporting statement on this matter. At the outset, ITLOS notes that most anthropogenic GHG emissions which cause marine pollution originate from land-based sources, and in addition, from vessels and aircraft. It is important to acknowledge global shipping's contribution to the climate crisis, given that the sector accounts for an astounding 3% of global emissions.

When it comes to specific obligations with respect to emissions from vessels, ITLOS outlines that UNCLOS imposes an obligation on flag States to adopt laws and regulations to prevent, reduce and control marine pollution from vessels. Such laws and regulations must meet the minimum standard of generally accepted international rules and standards established through the International Maritime Organization (IMO). However, the stringent nature of the general obligation to take 'all necessary measures' is broader and goes further. States are therefore well advised to go beyond this threshold which should be viewed as a bottom floor. Next to obligations to adopt legislation and regulation, there are also corresponding enforcement obligations.

With respect to specific obligations applicable to GHG emissions from or through the atmosphere (which also encompass shipping emissions), it is also worth noting that States have an obligation to endeavour to establish international rules, standards and practices and procedures, making every effort in good faith and on a continuing basis.

IMPLICATIONS FOR POLICY PRACTICE IN GLOBAL SHIPPING

Our recent legal briefing for policymakers, which also contains a detailed legal analysis of the ITLOS advisory opinion, sets out implications for policy practice in global shipping.

First, States should adopt domestic legislation and regulation to address the climate

'Human-caused GHG emissions fall within the definition of ''pollution of the marine environment'' and therefore States are subject to a wide-ranging set of obligations under UNCLOS to address GHG emissions'

Isabela Keuschnigg

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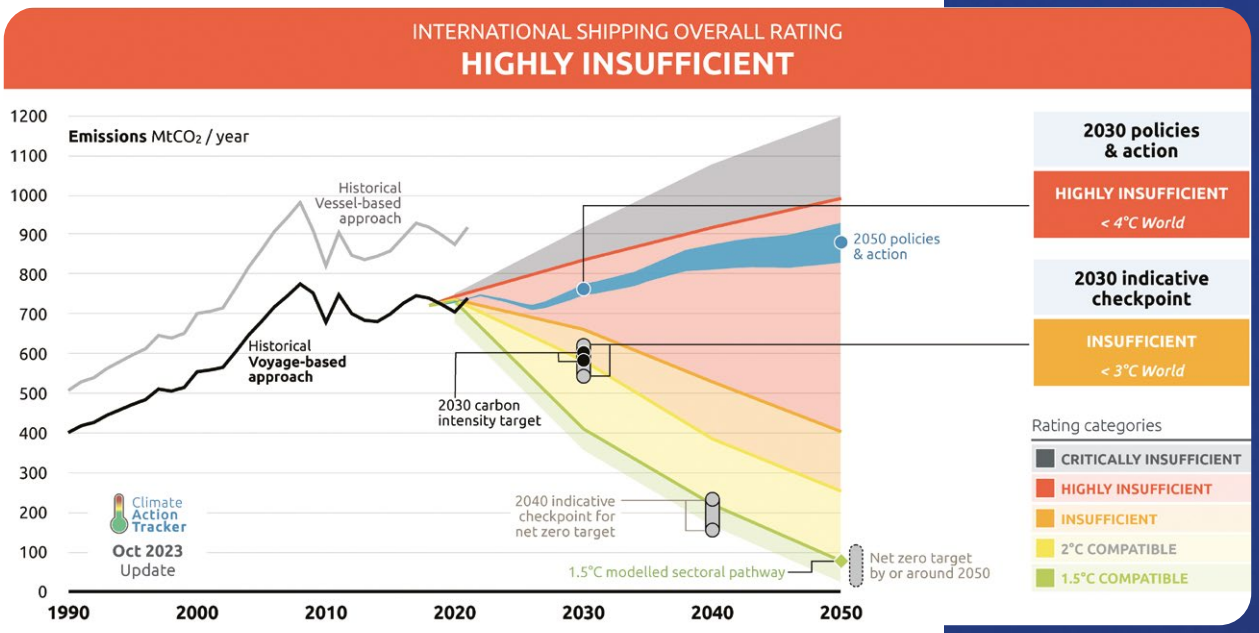

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impacts from global shipping which are aligned with a 1.5°C pathway. Given that current IMO rules don't put the sector on such a pathway, States should introduce domestic legislation and regulation that go beyond these rules, are guided by the best available science and steer the sector firmly on course to a liveable future for all.

Second, States need to take all necessary measures to prevent, reduce and control marine pollution caused by anthropogenic GHG emissions, including from shipping. Now is the time to include and account for international shipping's climate impacts in States' domestic climate pledges under the Paris Agreement, known as Nationally Determined Contributions, a new round of which is due early 2025.

Third, States should continue to work through the IMO and to make every effort in good faith to establish ambitious international rules to tackle climate impacts from shipping and to align global efforts with a 1.5°C pathway. At the next revision scheduled for 2028, the 2023 IMO Strategy on Reduction of GHG Emissions from Ships should be revised in line with the goals of the Paris Agreement. Even more pressing, the IMO's 'basket of mid-term measures', due to be adopted in 2025, should be ambitious and 1.5°C aligned.

Fourth, developed States should provide financial assistance to (in particular, climate vulnerable) developing States. This could be implemented through the current proposal for an 'economic measure' as part of IMO discussions which is an opportunity for States to provide transition support to developing and climate vulnerable countries.

> 'The ITLOS advisory opinion has the potential to inform climate change lawsuits around the world'

TURNING THE TIDE IN OCEAN PROTECTION

Given the non-binding legal nature of the advisory opinion, some may wonder if the ripples this advisory opinion has caused will turn into bigger waves – or if it may even turn the tide in global climate action and ocean protection. I believe there are multiple reasons to be hopeful for the latter.

At the outset, advisory opinions by international courts are considered to carry 'great legal weight and moral authority'. The ITLOS advisory opinion on climate change and the marine environment has provided important guidance on what States must do to mitigate GHG emissions and protect the ocean from harmful climate impacts with a view to complying with their obligations under UNCLOS – which are legally binding.

Given the stringent standard of conduct States have under UNCLOS, the ITLOS advisory opinion has the potential to foster ambition both in the domestic as well as in the international policymaking arena. For example, at the opening plenary at the 4th International Conference on Small Island Developing States (SIDS), many world leaders hailed the ITLOS advisory opinion which was considered a big win for SIDS.

However, implementation of the advisory opinion ultimately boils down to political will. The political developments following a recent human rights win secured by a group of senior Swiss Women in the European Court of Human Rights illustrates this caveat all too well. While the Swiss parliament rejected the ruling in a vote, the German parliament passed a resolution which requested the government to examine the consequences of the ruling on its climate legislation.

Lastly, the ITLOS advisory opinion has the potential to inform climate change lawsuits around the world. There already exists a growing body of climate change litigation concerning the ocean, and the ITLOS advisory opinion has the potential to boost this movement. Particularly, it is expected to feed into the advisory opinion to be issued by the International Court of Justice (ICJ) which is tasked to look at States' obligations with respect to climate change flowing from the entirety of international law including UNCLOS. With its explicit reference to State responsibility, ITLOS unlocked the door for potential legal remedies and compensation – it is now up to the ICJ whether to open that door.

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Empowering change

Dorthe Karin Bendtsen of KPI OceanConnect looks at the critical role of environmental, social, and governance (ESG) principles in propelling the marine fuels industry towards sustainability and resilience

The maritime industry plays a significant role in the global economy, but it has often held limited appeal as a career option beyond a narrow group of people. Ongoing digitalisation, decarbonisation and a commitment to develop a more sustainable sector have significantly widened this appeal and, in response, the sector continues to evolve as an appealing environment for a wider, more diverse group of people. Robust ESG principles and especially diversity, equity, and inclusion (DEI) measures now play a vital role in building a sustainable and resilient industry that has the skills and capabilities needed to excel in a market with tightening environmental regulations and requirements for securing access to capital.

Businesses are acknowledging that navigating shipping's future challenges requires new paradigms and a broader range of ideas and perspectives. Increasingly, women are carving out new paths in this transition, challenging stereotypes, and eliminating barriers to success. Their stories are a testament to the transformative power of diversity.

At KPI OceanConnect, we recognise that promoting women in shipping isn't just a moral imperative; it's a strategic financial and competitive advantage. By being an attractive place for talented individuals to work and by amplifying women's voices in the shipping industry, we hope to inspire more women to pursue careers in this dynamic and vital sector.

EMBRACING THE 'S' AND THE 'G'

While environmental concerns remain crucial in discussions around sustainability, attention is widening to include social and governance aspects. Stakeholders, ranging from financial institutions to cargo owners, are increasingly holding the industry to higher standards, demanding greater transparency and accountability.

Companies aspiring to position themselves as industry leaders must adopt a comprehensive ESG approach, integrating social measures alongside environmental ones. Given the demanding nature of the industry, this means embracing good business practices to foster diverse teams and empower the best talent. At KPI OceanConnect, our commitment to diversity and gender equality is embedded in our corporate culture, where we actively foster an inclusive environment through initiatives like 'Women in Shipping', now in its third year.

As our CEO, Anders Grønborg puts it, 'By empowering more women to join and thrive in our organisation, we have improved our decision-making, enhanced innovation and ultimately boosted our financial performance.'

Investing in and fully embracing ESG represents not only a corporate responsibility but also a strategic imperative for future-proofing businesses. Transparency and accountability form the bedrock of trust, facilitating meaningful change and strengthening competitive advantage in individual businesses, as well as in the sector more widely.

The inclusion of women in shipping is about unlocking a wealth of untapped potential that will help us to best tackle the emerging challenges our clients face, from securing access to alternative fuels to navigating complex regulatory landscapes. By encouraging and supporting diverse perspectives, we create fertile ground for fresh ideas and collaboration which are important for achieving industry-wide transformation to decarbonise.

Improving performance on social measures significantly enhances workplace attractiveness and expands the recruitment and retention of a wider pool of talented individuals who have the skills and knowledge necessary to solve shipping's future challenges. This underscores the importance of fostering an environment that celebrates diversity and inclusivity, supporting the professional development of all employees. At KPI OceanConnect, we do this through various initiatives to promote employee wellbeing, encourage healthier work-life balance and career progression. We offer flexible work arrangements and five months paid parental leave, while also investing in continuous education and training for all employees, ultimately supporting the collective success of the organisation.

SUCCESS STORIES

KPI OceanConnect has earned a reputation for going the extra mile and thinking differently about our people. We believe in walking the talk and the power of mentoring and role modelling when it comes to diversity. We currently have an overall gender balance of 40% in the organisation with two of the top three executive management positions held by women. Furthermore, we continuously strive to ensure broader diversity at all levels of the organisation, not just on gender but also cognitive, cultural, age, sexual orientation and more.

> Promoting women in shipping isn't just a moral imperative; it's a strategic financial and competitive advantage'

Dorthe Karin Bendtsen

Take Victoria Freeman, our CFO, for example. Her journey from accountant to CFO within the organisation exemplifies the power of diversity within a meritocratic environment. In a 14-year career with KPI OceanConnect, and despite working in a male-dominated industry, Victoria has risen to the top, bringing new and progressive perspectives to our business' decision-making. As a female leader in a C-suite position, Victoria serves as a role model for aspiring professionals, demonstrating that gender is not a barrier to success in the maritime world.

Susanna Lai, Managing Director of our Hong Kong office, has a strong track record in fostering an inclusive and gender-balanced team, recognising each individual for the unique abilities and characteristics that they bring to the team. The result is a high performing team that delivers expert advice and service to our business partners. Susanna's leadership underscores the strategic advantage of gender diversity not just in driving success for the company but also in fostering positive change within our industry.

My own experiences at KPI OceanConnect also validate this. My career journey from Executive Assistant to COO has been underpinned by commitment, resourcefulness, and hard work towards building the leading professional organisation we are today. However, it would not have been possible without a culture that champions diversity, inclusive leadership and innovation.

It isn't only about individual success stories; it's about cultivating a culture of empowerment where all employees can thrive and excel. We want our organisation to be resilient and dynamic in an evolving industry, and it's our people who enable this. By creating an environment where everyone feels valued, respected, and free to express their views and who they are, we can help employees reach their full potential. A company culture marked by personal responsibility, accountability, and openness is essential for business success, fostering innovation, productivity, and better service delivery – it will be critical in driving industry change and sustainability.

We work in partnership with our clients, and we want them to take confidence in knowing they are supported by a global, skilled workforce driven by excellence. A partnership approach requires strong, confident, and skillful professionals, as we form an essential link in our clients' supply chain and have a key role to play in supporting them to develop fuel strategies and tailored solutions that meet both sustainability and commercial goals.

COLLABORATION FOR CHANGE

The challenge facing businesses to operate sustainably covers a broad scope, including social, governance and environmental aspects. Progress will be most effectively achieved through collaboration with partners across the industry and value chain. This will help to accelerate not only the energy transition but change for a more sustainable sector overall. Particularly around the environment, sharing resources and expertise will help accelerate the development of infrastructure required in the energy transition, and in our industry facilitate widespread adoption of alternative marine fuels. Whether it's knowledge exchange or aggregating demand for alternative fuels, partnerships play a pivotal role in reshaping the marine fuels landscape.

Companies committed to operating and behaving sustainably can enhance their credibility and standing among stakeholders, creating a reputation that makes it easier to gather support for and investment in sustainable fuel initiatives. This will help to facilitate and drive the transition to alternative fuels and help our industry meet its net-zero targets more effectively.

As we confront the complexities of maritime decarbonisation, it is imperative sustainability is embraced as an ongoing journey. Diversity, inclusivity, and sustainability all need to be championed, clear targets should be set, progress monitored, and a culture of continuous improvement embraced so that we can achieve a sustainable future together.

Dorthe Karin Bendtsen,
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Safe passage

Safetytech Accelerator's **Seb Corby** looks at initiatives underway which can help the maritime industry manage the safety hazards posed by its decarbonisation journey and the adoption of new fuels

Shipping is undergoing a green transformation. For over a century, the sector has mainly relied on fossil fuels to power the huge engines that drive ships loaded with iron ore, fuel, grains, and consumer goods across the oceans. However, things are quickly changing. Compared with other forms of transport, shipping remains the most sustainable way of carrying large quantities of goods across vast distances, supporting more than 80% of world trade. As the industry moves towards a fully decarbonised future, it faces sweeping changes such as the adoption of alternative fuels, the implementation of new propulsion technologies, and stringent regulatory requirements aimed at reducing greenhouse gas emissions.

ALTERNATIVE FUELS AND TECHNOLOGIES

The industry is embracing a significant shift towards alternative fuels such as liquefied natural gas (LNG), biofuels, and hydrogen, alongside the adoption of advanced propulsion systems. These innovations are designed to sustain global economic growth while minimising environmental impact. However, the green transition introduces a spectrum of new risks and safety challenges that must be addressed to foster a truly sustainable maritime environment. Risks to assets, operations, and personnel are evolving. As operational methods change, new points of failure emerge, necessitating a thorough re-evaluation of risk management practices across the maritime sector.

THE RISK LANDSCAPE

The integration of new technologies increases complexity. Advanced systems demand specialised knowledge and expertise, presenting a steep learning curve for operators. Maintenance challenges arise as these technologies introduce unique requirements and procedures. Furthermore, the financial risk associated with investing in, and the uncertainty around the return on investment for, new technologies cannot be ignored.

Compliance with rapidly evolving regulations adds another layer of complexity. The regulatory landscape for maritime emissions is stringent and dynamic, requiring constant vigilance and adaptation from shipping companies. Safety hazards associated with alternative fuels like hydrogen pose significant risks if not managed correctly. Additionally, human factors, including the inexperience of crew members with new technologies, further exacerbate these challenges.

CHANGING CARGO AND NEW RISKS

The rapid growth of electric vehicles (EVs) and the increasing demand for consumer electronics have led to a significant rise in the transportation of lithium-ion batteries across the

globe. According to the International Energy Agency (IEA), global electric car sales surpassed 10 million in 2022, representing a 43% increase from the previous year. The global EV market is projected to grow at a compound annual growth rate (CAGR) of 21.7% from 2023 to 2030, significantly increasing the demand for lithium-ion batteries. Additionally, the global market for consumer electronics is expected to reach $1.5 trillion by 2025, driven by the increasing adoption of smartphones, laptops, and other portable devices.

'The green transition introduces a spectrum of new risks and safety challenges that must be addressed to foster a truly sustainable maritime environment'

As a result, the production and shipment of lithium-ion batteries have surged. For the maritime industry, this poses unique challenges and risks. The rise in the transportation of lithium-ion batteries has led to a 50% increase in maritime incidents involving battery fires over the past five years, as reported by the International Maritime Organization (IMO).

TECHNOLOGICAL SOLUTIONS FOR RISK MANAGEMENT

At the same time as the risk profile is changing, we are also seeing the onset of a vast number of new, cutting-edge technologies that can change the game in risk management. Emerging technologies such as artificial intelligence (AI), robotics, big data, and advanced sensors present a unique opportunity to enhance safety and operational efficiency in the maritime industry at a crucial time. These technologies are reaching maturity and are poised to deliver significant improvements in how we manage and mitigate risks. Programmes like the Cargo Fire and Loss Innovation Initiative, spearheaded by Safetytech Accelerator, are crucial in leveraging new technology for risk management in maritime.

COMPLEX SYSTEMS, TIGHT COUPLING, AND CASCADING FAILURE

Maritime decarbonisation involves the integration of a variety of advanced technologies, such as alternative fuels (LNG, hydrogen, ammonia, methanol etc.), hybrid and electric propulsion systems, and sophisticated emissions control systems. These technologies are interconnected, creating a network of dependencies that can complicate operations and maintenance. For instance, the adoption of alternative fuels necessitates modifications across the fuel storage, handling, and engine systems, each requiring precise synchronisation to ensure overall system compatibility and safety. This interconnectedness increases the complexity and the potential for systemic risks. In tightly coupled systems, common in maritime decarbonisation efforts, a failure in one component can quickly propagate through the entire system, leading to cascading failures. For example, a malfunction in the power management system of a hybrid propulsion setup can result in a total loss of propulsion, severely compromising the vessel's operational capability and safety. These cascading effects highlight the importance of understanding and managing the intricate interdependencies within maritime decarbonisation technologies to prevent widespread disruptions and failures.

MAINTENANCE CHALLENGES

Maintenance of maritime decarbonisation technologies is critical to ensuring their reliability and effectiveness. For example, scrubber systems, which are used to reduce sulphur emissions from ships, require regular cleaning and part replacements to function properly. A 2020 report from the Exhaust Gas Cleaning Systems Association (EGCSA) highlighted that improper maintenance of scrubbers could lead to system failures, resulting in increased emissions and operational inefficiencies. This example underscores the necessity of meticulous maintenance schedules, the availability of specialised parts, and the presence of skilled technicians. Without these elements, the intended environmental benefits of scrubbers and other decarbonisation technologies could be compromised, leading to both regulatory non-compliance and economic losses for shipping companies. Ensuring robust maintenance practices is therefore essential to the successful implementation of maritime decarbonisation initiatives.

The adoption of new fuels such as hydrogen in maritime decarbonisation introduces significant safety hazards. Hydrogen is highly flammable and requires stringent handling and storage protocols to prevent accidents. The risks associated with hydrogen include potential leaks, which can lead to explosions or fires if not properly managed. According to the IMO, the implementation of hydrogen as a marine fuel demands advanced safety measures, such as enhanced ventilation systems and specialised detection equipment, to mitigate these risks.

The integration of advanced decarbonisation technologies in the maritime industry introduces significant human factors challenges. Crew members must adapt to the complexities of new systems such as hybrid propulsion and emissions control technologies, which demand a higher level of technical expertise and specialised training. The cognitive load associated with operating and maintaining these sophisticated systems can increase the likelihood of human error, potentially compromising safety and efficiency. A 2020 study by the Marine Technology Society (MTS) highlighted that insufficient training and the rapid pace of technological change can lead to gaps in knowledge and skills among maritime personnel.

NEW TRENDS IN TECHNOLOGY

Cost to Performance Curve Generates Exponential Adoption: One significant change in recent years is the dramatic drop in the cost of sensor hardware, coupled with increasing power in cloud computing and local chip capabilities. As the cost-to-performance ratio becomes more attractive each year, the risk of investment decreases and the business case becomes clearer. The performance profile is just as important as the drop in cost. Established maritime networking providers can now demonstrate proof points of total ship coverage at low costs, a feat that was uncertain even a few years ago. As more proof points are generated, the risk profile lowers further, leading to exponential adoption.

AI and Internet of Things (IoT) Convergence: AI and IoT hardware have always been intricately linked. We are now seeing fascinating and practical convergences of these technologies. This includes both novel microchips and legacy technologies. For example, carbon nanotubes, discovered 30 years ago, are now being manufactured on chips as molecular detectors. These detectors, combined with advanced AI, create E-noses that function similarly to a human nose. In terms of ships and shore

infrastructure, this means no longer relying on specifically calibrated gas sensors that detect a single gas. Instead, AI-driven E-noses can discern individual signatures of events, from spills to gas releases. Cargo Fire and Loss is the only programme globally exploring these advancements in maritime. The trend of AI unlocking legacy hardware extends further; infrared thermography is an excellent example of how advancements in camera technology are combined with cutting-edge machine learning algorithms to detect everything from minute cracks in infrastructures to early fire detection. Cargo Fire and Loss is also supporting the development of further AI-driven fire detection solutions: radio wave analytics. As radio waves travel between a transmitter and receiver, their traversal through different mediums, from densities of stock to temperature, impacts their state. Advanced AI is now learning to distinguish that state change as an indication of risk. Pilots in Cargo Fire and Loss are now showing that this is accurate down to temperature changes of a few degrees.

Cross-Industry Innovation: Another key aspect is cross-industry innovation. For example, the increase in climate disasters, notably forest fires, has led to a rapid increase in the number of innovations in this space. Several cutting-edge startups have produced cheap and robust multi-sensors that detect a host of different particulates and gases on a single sensor. Cargo Fire and Loss is now bringing this innovation into maritime, as many of the challenges of fire detection within forests are mirrored in maritime environments. Leveraging advancements from other industries is key, especially in maritime, where there haven't necessarily been the same drivers for progression seen elsewhere.

CHALLENGES OF INTEGRATING NEW TECHNOLOGIES

Despite their transformative potential, these technologies are often developed by start-ups, which can present challenges for integration into established maritime operations. Startups may lack the resources to scale their solutions for large shipping companies or the experience to navigate the regulatory landscape. The disparate nature of startup innovations and established maritime technology ecosystems can lead to compatibility issues and operational disruptions during the integration phase, so it's key that change is managed precisely and the right partners are chosen.

Safetytech Accelerator's Cargo Fire and Loss Innovation Initiative has demonstrated the power of these technologies when effectively managed. This programme has successfully integrated IoT sensors and AI analytics to monitor cargo conditions in real-time, significantly reducing the risk of fires and losses. By fostering collaboration between maritime operators and technology startups, the initiative has shown that with the right support, startups can provide powerful solutions that enhance safety and operational efficiency.

Established by Lloyd's Register in 2018 and incorporated as an autonomous business in 2021, Safetytech Accelerator focuses on the challenges faced by safety-critical industries and critical infrastructure.

Safetytech Accelerator's programmes include: the Methane Abatement in Maritime Innovation Initiative (MAMII); the Cargo Fire and Loss Innovation Initiative; and Waypoint, which acts a bridge between maritime organisations and the technology ecosystem.

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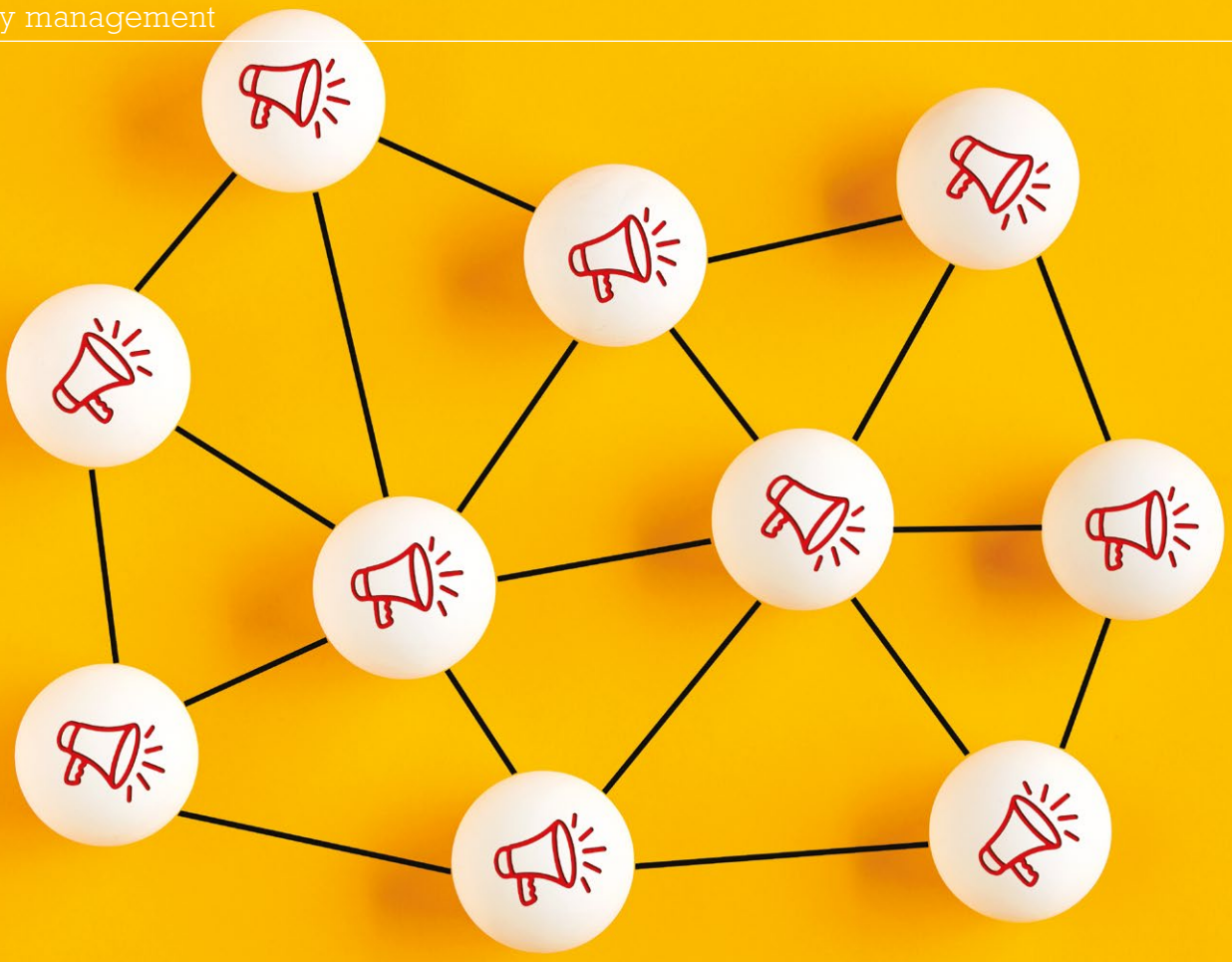

It's good to share

As the maritime industry embraces alternative fuels and new vessel designs, sharing safety incident reports will help ensure that shipping makes the green transition with minimal disruption and incidents, writes CHIRP's **Adam Parnell**

As emission reduction targets loom, crews will soon be handling multiple new fuels, all of which come with their own bunkering and operating risks. In this learning phase, the number of safety incidents could be high. Suppose companies want to prevent avoidable safety incidents with their crews, and costly downtime. In that case, our industry will need to get better at sharing this information with everyone, rather than keeping important learnings under lock and key in their own companies. For many, concerns about sharing this information will remain commercially competitive – so this is where confidential reporting can play a vital role.

Our industry must quickly familiarise itself with how to safely use and transport these new fuels globally, including highly explosive hydrogen, corrosive methane and toxic ammonia, not to mention the safe use and maintenance of nuclear power, which is becoming more widely discussed as a viable option with the use of small modular reactors. Sharing near misses and safety incidents that crews and shipping company staff encounter via anonymous reporting services like the Confidential Human Factors Incident Reporting Programme (CHIRP) can help us pool our collective knowledge and then share safety lessons and trends so that we learn from each other's experiences.

We'll need to learn quickly what effect these fuels have on our engines, the unique safety measures needed when bunkering them, the training required for crews and what will be needed to protect the marine environment and coastal communities. Any major incident involving loss of life or an impact on marine ecosystems or people living ashore could see significant setbacks in new fuel use and adoption.

Our industry cannot afford such setbacks that could delay achieving the fast-approaching and ambitious decarbonisation targets as laid out by the IMO. Companies must also consider the costly impact major safety incidents on vessels using alternative fuels could have on business continuity and company reputation. If companies do not share their near misses, best practices and safety incidents, which they will inevitably experience when using new fuels, we could risk missing decarbonisation targets. Sitting on important safety lessons will need-

lessly endanger seafarers, and the marine environment and could give shipping a bad public image. It could also make it harder to demonstrate ESG goals (especially the 'social' element) and unlock green funding to help with the zero-emission transition.

To reach net zero safely and at the pace required, we need a cultural shift in how we share our safety data. It all boils down to one thing, shipping companies are going to have to get comfortable with encouraging their teams to report safety issues internally without fear of retribution and also openly share lessons with the wider industry.

SCARED OF SHARING

Why don't shipping companies learn from each other, and encourage a culture of reporting and sharing? The transition to new fuels is an investment-heavy process, and acknowledging any kind of safety incident could be costly if it leads to a loss of consumer, stakeholder or investor confidence. This can result in reporting of safety incidents being discouraged or the vital learnings being locked within individual companies. We need a radically different approach if we are to reach our shared decarbonisation goals. During times of change, companies need to encourage and reward people for speaking up. To get there we may need to tip the scales far in the other direction and promote a culture of overreporting – no issue too little – to counteract what for some companies may be decades of underreporting incidents.

Fear of retaliation can dissuade people from reporting safety incidents, but a truly just culture prioritises understanding over blame. That means that we work towards a 'no blame' environment where wrongdoings are acknowledged and learnt from, as opposed to being used for punishment. The goal is to learn from the situation and improve processes, not point fingers.

While seafaring and shore-based personnel may be hesitant to report internally, third-party independent organisations such as CHIRP provide the safe space and expertise for maritime personnel to report without the fear of repercussions. We ensure that any identifiable details such as name, and company remain confidential, and this commitment to safeguard the reporter empowers our programme to be a trusted and valuable tool for the industry.

> 'We need a tight loop of reporting and feedback systems so that decisions are made based on reality'

Fostering a culture of learning and sharing both internally and externally will ultimately benefit all stakeholders, which is essential during this period of transition.

FROM THE BRIDGE TO THE BOARDROOM

Seafarers, or the 'human element' all too often get the brunt of the blame for incidents, but we need to assess the entrenched hierarchical structures we have in place in maritime. Often, people in higher management positions do not want to hear or pass on safety incidents to the board room, where important changes could then be enacted, for fear of damaging their upward progress or seeming incompetent. In our experience, safety incidents onboard often have their genesis in the boardroom and decisions that leaders make, particularly when they are too far removed from what's happening at operational levels and do not listen to or take on board feedback. We need a tight loop of reporting and feedback systems so that decisions are made based on reality. Senior leadership should accept evolution from the frontline rather than the usual top-down process. As we move into new fuel territory, learning will be an ongoing process, and it is seafarers who will be the ones with the valuable practical experience.

Image © CHIRP

Adam Parnell

As underscored in the IMO's World Maritime Day theme, as we navigate the future we must put safety first. While we have a strong baseline of safety regulations and guidance, these are often minimum requirements. Think of going above and beyond as a proactive insurance policy. The potential consequences and costs of an incident from the use of new fuels could be far more severe than the cost of training and hiring additional personnel. Safety incidents can result in significant financial losses, reputational damage, and even legal repercussions.

THE FUTURE IS HERE

With single and dual fuels, hydrogen, methane, ammonia and nuclear coming into play as our industry moves towards achieving zero or near zero GHG emissions, we must understand that the safety consequences of new fuels are significantly higher than traditional fuels. Leaks of ammonia, for example, even the tiniest amount, can not only affect a ship's crew but local wildlife and communities as well.

One of the outcomes of the IMO Maritime Safety Committee meeting (MSC 108) held recently was the 'development of a safety regulatory framework to support the reduction of GHG emissions from ships using new technologies and alternative fuels'. This includes the assessment of risks, hazards and technical aspects as well as safety obstacles and existing gaps. What is apparent is that we are all still learning, and the current reporting systems must improve if we are to be prepared for the challenges that new fuels and technologies will bring.

We need to accelerate the creation of a reporting culture and framework, and actively encourage all staff to use it, without fear of retribution. Importantly, we need to share this knowledge with the entire industry. CHIRP is on hand to be a trusted repository for this data, as well as analyse wider trends and share best practices with the industry – it's what we have done for decades and a role we see as vitally important as we strive for ever greater levels of safety, moving into this new decarbonised era.

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Smooth transition

Gulf Marine's Technology Team explains how marine lubricants are playing a critical role in the decarbonisation of the maritime industry

For several decades, heavy fuel oil (HFO) has been the dominant marine fuel for the shipping industry primarily because of its low cost, widespread availability, and developed bunkering infrastructure. However, in recent years, the International Maritime Organization (IMO) has progressively tightened regulations that limit marine fuel sulphur content, nitrogen oxides emissions, and greenhouse gas (GHG) emissions. The latest GHG strategy includes an objective to reach net-zero GHG emissions by 2050, with a commitment to ensure an uptake of alternative zero and near-zero GHG fuels by 2030.

The marine shipping sector will need to undergo significant transformation in order to comply with these environmental regulations and targets. The stringent focus on maritime decarbonisation has driven the development of alternative fuels, new engine concepts, and improved operating practices. However, adopting these changes presents considerable complexities for vessel operators. For instance, the transition to the new low-carbon alternative fuels, which the IMO estimates will contribute significantly to the industry's decarbonisation efforts, requires clearer fuel specifications and bunkering systems, etc.

Given the increased complexities, the maritime decarbonisation transition will need be approached on a global basis with close collaboration among diverse stakeholders across the entire value chain.

MARINE LUBRICANTS' ROLES

Dr Edward Ng, Gulf Marine's Technology General Manager, points out the critical role of marine lubricants in the industry's decarbonisation transition. He explains: 'Marine lubricants play very key roles in helping the industry achieve its decarbonisation goals. On top of enabling the use of alternative fuels, we are exploring the potential of lower viscosity lubricants to reduce energy consumption and CO_2 emissions, as well as developing novel chemistries to enhance engine reliability. Certainly, with the increased use of re-refined base oils, we will improve lubricant circularity. So, indeed, lubricant developers are crucial to achieving decarbonisation goals.'

Lubricants have been considered in key marine propulsion innovations, and most mainstream engineers do integrate lubricant considerations into Gulf Marine's development projects. Yet not many people are aware of the criticality of marine lubricants for marine decarbonisation. It is hence imperative that

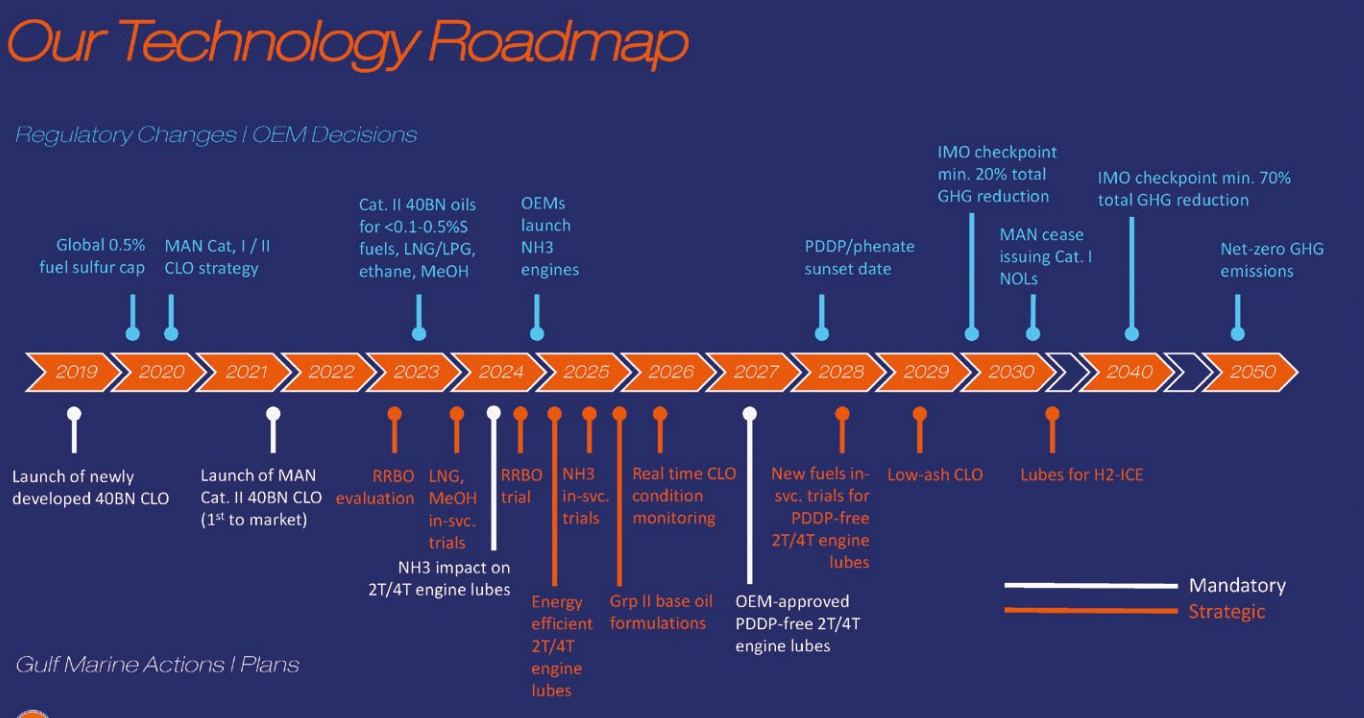


Diagram 1: Gulf Marine Technology Roadmap

Irwan Jaafar and Vincent Ang, on-board the trial ship for the product performance assessments

lubricant developers strengthen efforts to inform and educate industry stakeholders.

TECHNOLOGY ROADMAP

Gulf Marine's Technology Roadmap outlines its strategic framework for innovation and adherence to evolving regulations and standards (see Diagram 1).

The roadmap provides a good underpinning for its product development strategy. Gulf Marine was the first in the market to launch a Cat. II 40BN CLO. This demonstrated its technology leadership; providing solutions that cater to evolving market needs for improved lubricant performance, ensuring engine optimal performance in the face of fuel quality variances as well as increasing fuel varieties or options, such as LNG, LPG, ethane, and methanol.

MULTIPLE ALTERNATIVE FUELS

Irwan Jaafar, Gulf Marine's Global Technical Manager, shares his perspective on the new era of marine fuels for two-stroke engine lubricants. He emphasises the need to understand the different characteristics and combustion effects of each of the alternative fuels. He also underscores the significance of staying informed about any adjustments that original equipment manufacturers (OEMs) might be implementing in their engine hardware designs during the development of these new lubricants. Therefore, Jaafar works closely with OEMs like MAN ES, WinGD, Wärtsilä, and others to address their specific lubricant requirements. Additionally, Gulf Marine is actively engaged in projects with customers who are early adopters of ammonia as a fuel. The objective is to verify the compatibility of Gulf Marine's lubricants with ammonia fuel, ensuring optimal performance and longevity of marine engines operating on this alternative fuel source.

'On top of enabling the use of alternative fuels, we are exploring the potential of lower viscosity lubricants to reduce energy consumption and CO_2 emissions, as well as developing novel chemistries to enhance engine reliability'

RE-REFINED BASE OILS

Gulf Marine's initiative to incorporate re-refined base oil (RRBO) into its cylinder oil represents a significant step towards reducing carbon footprint. Here are some key points:

Environmental benefits: Re-refining used oil into base oil is environmentally beneficial as it prevents used oils from being disposed of improperly or incinerated, which can be harmful to the environment. It conserves natural resources by reducing the dependency on virgin crude oil and minimises waste generation.

Support from OEMs: Major OEMs with whom Gulf Marine collaborates closely are supportive of this initiative. This indi-

cates confidence in the quality and performance of RRBO in marine applications.

Testing and results: Gulf Marine has conducted laboratory tests with positive results, demonstrating that RRBO meets or exceeds the performance standards required for cylinder oils. Currently, they are progressing to real-world engine testing to validate these findings under operational conditions.

Impact: By adopting RRBO, Gulf Marine is nudging the maritime industry towards more sustainable practices. This move not only aligns with regulatory and environmental goals but also positions Gulf Marine as a leader in promoting eco-friendly solutions within the sector.

MORE TESTING NEEDED

Gulf Marine has also undertaken testing and trials for LNG, LPG, and methanol in collaboration with vessel operators, OEMs and others to validate its products' performance remains robust with these different fuel types. This year, the focus will expand to include the impact of NH_3 on engine lubricants. This underscores Gulf Marine's commitment to playing its part to ensure that the adaptation of the new fuel types does not compromise engine health and efficiency.

Vincent Ang, Gulf Marine's Global Formulations Manager, highlights the development of higher-performance 2-stroke marine cylinder oil with enhanced cleaning abilities as the marine industry transitions to low-carbon alternative fuels.

Ang explains the need for rigorous deposit control testing during product development. These assessments are essential to ensure that the oil does not contribute to deposits on engine metals when exposed to high temperatures. The lubricant must effectively disperse combustion by-products and contaminants, preventing them from settling on engine surfaces and maintaining overall cleanliness.

> 'Gulf Marine will continue to proactively provide lubrication solutions that anticipate and exceed global standards'

Another critical aspect is oxidation resistance. It is important to ensure that the oil does not oxidise easily, as oxidation can lead to oil thickening. Thickened oil can restrict flow around the piston ring, which could be exposed to intense heat for prolonged periods. This can exacerbate deposit formation. With deposits acting as insulators, that can further increase local temperatures, promoting even more deposits.

Ang adds that the combustion process of some of the new fuels may produce various acids. It is crucial for the oil to offer robust protection against these acids. This is achieved by employing advanced detergent boosters, which are blended to create a 'cocktail' that effectively neutralises acids and safeguards engine components.

Furthermore, the oil is required to be engineered with advanced wear protection additives to minimise metal-to-metal contact. This critical feature not only reduces friction and wear (and hence improves engine efficiency) but also significantly extends the operational lifespan of engine liners and piston rings, ensuring enhanced durability and performance.

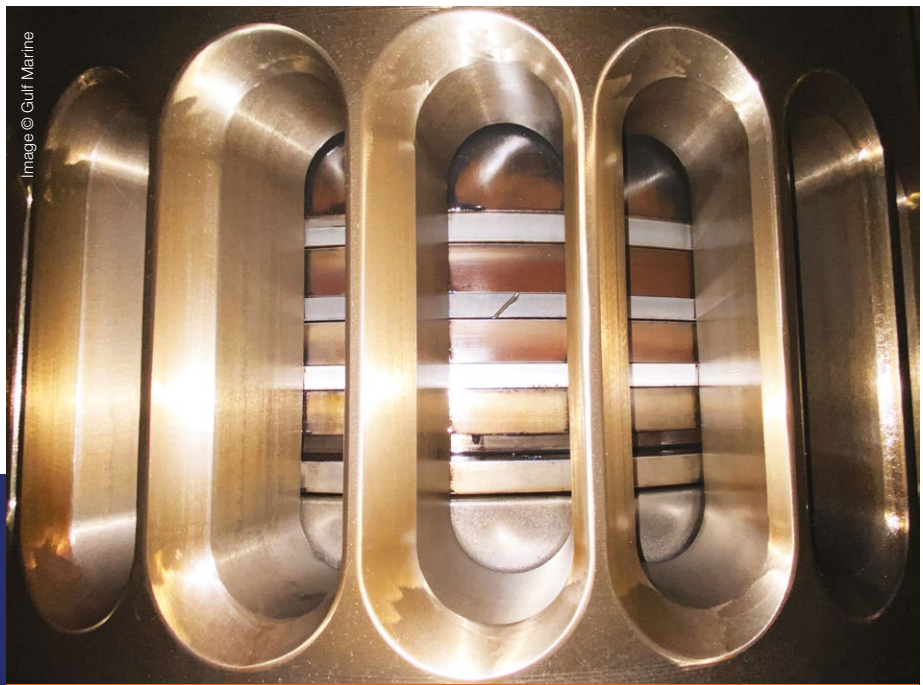
FURTHER DEVELOPMENTS

Gulf Marine's technology roadmap indicates that there is more development work ahead. By 2026, Gulf Marine expects to launch an enhanced cylinder oil condition monitoring system for vessel operators. This advancement enables more timely and precise adjustments and optimisation of oil usage, enhancing engine efficiency and reducing unnecessary waste while ensuring engine operability. Towards 2030, Gulf Marine aims to introduce low-ash cylinder oils and specifically formulated lubricants for hydrogen-fuelled internal combustion engines (H2-ICE).

WORKING COLLABORATIVELY

As Yew Meng Kwok, Gulf Marine's Technical Director, concludes: 'Gulf Marine is committed to collaborating with key shipping stakeholders to work towards the maritime industry's decarbonisation goals. Our focus on developing advanced lubrication technologies to enable the use of alternative fuels has positioned us as both a technology leader and a dedicated partner of our customers' decarbonisation efforts.

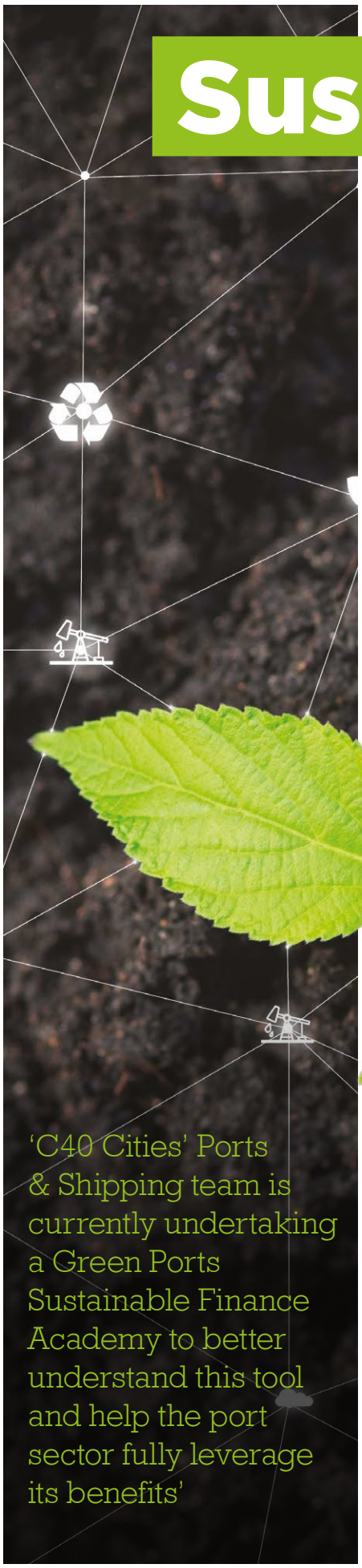
'By staying ahead of industry developments with evolving regulations and technology advancements, Gulf Marine will continue to proactively provide lubrication solutions that anticipate and exceed global standards.'



Superior Cleanliness: Deposit-free of the piston rings

A wholly owned subsidiary of Gulf Oil International within the Hinduja Group of companies, Gulf Marine has been supplying marine lubricants since 2008

Tel: +65 6592 0120
Web: www.gulf-marine.com



Sustainable links

As sustainability-linked loans become a growing feature in the port financing space, C40 Cities explores the link between corporate sustainability plans and lower financing rates

Sustainability-Linked Loans (SLLs) are an innovative tool for port authorities and port concessionaires to finance their capital expenditure (Capex) at cheaper interest rates, by tying the loan to corporate, sustainability-linked Key Performance Indicators (KPIs). C40 Cities' Ports & Shipping team is currently undertaking a Green Ports Sustainable Finance Academy to better understand this tool and help the port sector fully leverage its benefits.

Decarbonising the port & shipping industry is anticipated to cost several trillion dollars over the next decade. This seismic shift, in an already capital-intensive industry, will require port authorities and port concessionaires to tap every available pocket of funding and financing. But here is the silver lining: when it comes to financing green port projects, sustainability is not just a cost centre – on the contrary. Banks and institutional investors, having made significant pledges toward their own sustainability objectives, are now actively looking to foster environmental and societal changes throughout their portfolios. SLLs are a good example of this recent trend: ports raising hundreds of millions for general Capex facilities at a discount compared to traditional credit facilities, by leveraging their corporate sustainability plans.

Port of Melbourne is a recent example of this trend, having completed last year an AUD $475 million SLL as part of its decarbonisation strategy. The loan facility, financed by a syndicate of banks, links to two sustainability indicators covering scope 1 and 2 emissions reduction, and a mental health first aid workplace certification together with an overarching gateway target tied to engagement with port stakeholders to facilitate scope 3 emissions reduction.

Using case studies such as the Melbourne one, C40 Cities' Green Ports Sustainable Finance Academy convenes port cities, port authorities, and port concessionaires, as well as lenders, capital market investors, and potential borrowers. The aim is to explore the opportunities of SSLs and assemble a set of actionable best practices for future transactions. The end goal? Allowing all port stakeholders to make the most of their corporate sustainability plans and turn them into financing savings.

Are you an entity active in the port & shipping sector, and have first-hand experience in SLLs? C40 encourages you to reach out to share your perspective and be part of this Green Ports Sustainable Finance Academy.

'C40 Cities' Ports & Shipping team is currently undertaking a Green Ports Sustainable Finance Academy to better understand this tool and help the port sector fully leverage its benefits'

Image © Shutterstock

C40 Cities is a global network of nearly 100 mayors of the world's leading cities that are united in action to confront the climate crisis

Email: ports@c40.org
Web: www.c40.org

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bunkerspotted...

Bunkerspot captures some memorable moments in... Athens, Las Palmas, Rotterdam, Oman and London

Llewellyn Bankes-Hughes meets H.E. Julie Lymberopulos, Ambassador and General Consul of Panama in Greece

Petrospot's Will Mulhall and Lesley Bankes-Hughes ensure that *Bunkerspot* is on the press stand at Posidonia

Llewellyn Bankes-Hughes catches up with The Hon. Gemma Arias-Vasquez, MP, HM Government of Gibraltar's Minister for Maritime Services

Petrospot's Posidonia team, Lesley and Llewellyn Bankes-Hughes and Will Mulhall, attend the British Embassy reception

Nigel Draffin teaches a packed Alternative Fuels course during Maritime Week Las Palmas in June

Sofia Fürstenberg Stott of the Fürstenberg Maritime Advisory enjoys a cocktail during MWLPA24

Llewellyn Bankes-Hughes joins the MWLPA oil spill exercise with Beatriz Calzada, President of the Port Authority of Las Palmas

Victor Leóne, Business Development Manager at Bunker Partner, takes the stage at MWLPA24

Ambassador Nancy Karigithu of the Executive Office of the President of Kenya, delivers her keynote speech in Las Palmas

Pablo Sanso Gil, EMEA Regional Sales at Minerva Bunkering, speaking about bunkering at Maritime Week Las Palmas

Miguel Angel Bonnet Hodgson of the Port of Santa Cruz de Tenerife, discusses Tenerife's green credentials during MWLPA

Iryna Krasnikova of Tess Canarias celebrates MWLPA with Elba Bueno, Pia González O´Shanahan and Nicola Lombardi of FEDEPORT and the Canary Islands Maritime Cluster, and Kelli Houghton and Hannah Jeacock of Petrospot

Llewellyn Bankes-Hughes welcomes Pedro Suarez, President of the Port Authority of Tenerife, to Maritime Week Las Palmas

Laura Cabrero Francoso of Repsol and Luba Bogdanova of Addax Energy head towards the oil spill exercise in Las Palmas

Maritime Week Las Palmas Alternative Fuels training course students celebrate receiving their certificates from Beatriz Calzada, President of the Port Authority of Las Palmas

Llewellyn Bankes-Hughes, Nigel Draffin, Gavin Allwright, Secretary General of the International Windship Association, and Andres Caballero Quintana of the City Council of Las Palmas join forces during MWLPA

Miren Jugo Vilora takes a selfie on an open top bus in Las Palmas with Orinoco Surveying group colleague Emilio Antonio Garcia Vicent

Outside the Saybolt lab in Vlaardingen where the students test marine fuels during the BunkerExperience course

Shoshana Aranda of Malik Supply and Sylvester Hageman of Shell concentrate on a fuel quality test during BunkerExperience

Mexican student Natalia Cid of Netherlands-based ICI Methanol handles a sample of heavy fuel oil in the lab

Michael Asante of Viterra Chartering partners with Moses Komodatam of Engen Ghana in the Saybolt lab

Eline Kint of Oilchart International in Antwerp enjoys the BunkerExperience Tour du Port in Rotterdam

South African Michael Asante of Viterra Chartering surveys ships during the Port of Rotterdam boat tour

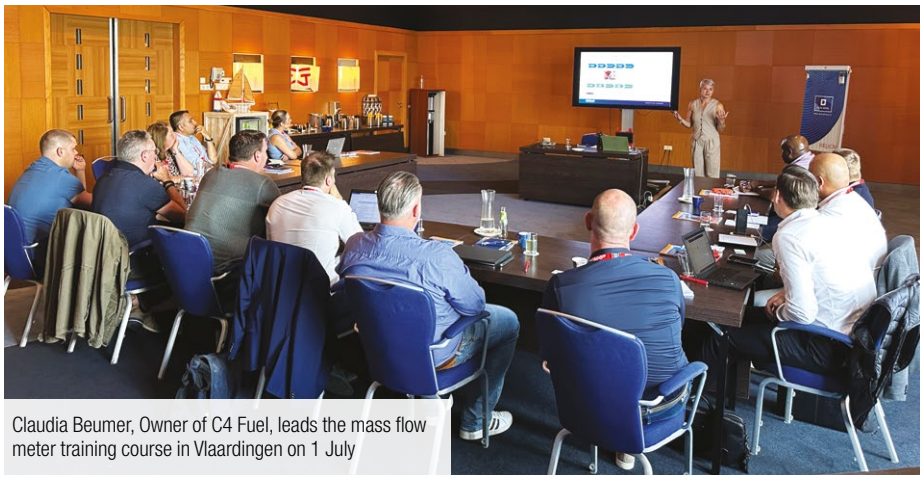
Petrospot's Osei Mitchell enjoys a sunny BunkerExperience port tour with student Ellen Lawrence and her father Scott of Numerco

Desiree van Beelen of Oilchart, Natalia Cid of OCI, Shoshana Aranda of Malik Supply, Megan Posthumus of FincoEnergies and Ellen Lawrence of Numerco bask in the Rotterdam sunshine

Engen Ghana's Moses Komodatam receives his BunkerExperience course certificate from Oiltraining's Ton Visser and Petrospot's Llewellyn Bankes-Hughes

Bunker suppliers, traders, surveyors, barge operators, fuel testing agencies and a meter manufacturer join Petrospot's mass flow meter training course in Vlaardingen, Rotterdam

Jurgen Janssens, SHEQ Manager at Belgian barging company Victrol, watches the river flow during the course



Claudia Beumer, Owner of C4 Fuel, leads the mass flow meter training course in Vlaardingen on 1 July

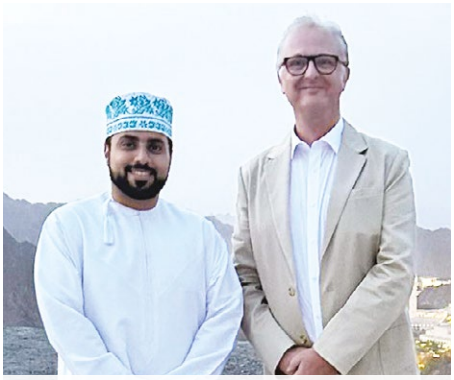
Claudia Beumer models her new hi-vis C4 Fuel jacket amongst the container terminals at Maasvlakte

Shoshana Aranda of Malik Supply in Denmark prepares to board a bunker barge during BunkerExperience

Alexandre Carvalho of Petrobras swaps Rio de Janeiro for the BunkerExperience bunker barge visit at Maasvlakte

BunkerExperience student and Bureau Veritas surveyor wear gas masks to take ullage measurements

BunkerExperience students pose for photos opposite the Maasvlakte container terminals



Salim Al Baimani of O Bunkering meets Petrospot's Simon Robotham in the heat of Oman

Simon Robotham and Lesley Bankes-Hughes visit Omar bin Mahmood Al Mahrizi, CEO of Sohar Freezone, and Emile Hoogsteden, CEO of the Port of Sohar

Simon Robotham and Lesley Bankes-Hughes catch up with Saulaiman A Hadhrami, CEO of Hormuz Bunkering

Ana Maria Boghici of the Oman American Business Council discusses the Oman Maritime, Ports & Energy Forum

Amer Jaboob, Director B2B at the Oman Oil Marketing Co., welcomes Lesley and Simon to Muscat

The Petrospot team meets Michael Eyley, Director of Trade & Investment at the UK Embassy in Muscat

HMS Belfast provides the backdrop to Ton Visser, Owner of Oiltraining BV, Llewellyn Bankes-Hughes, CEO of Petrospot, Martin Crawford-Brunt, CEO of Lookout Marine, and Anthony Mollet, CEO of the Marine Fuels Alliance

On the move...

EUROPE

Ellie Horne, previously with OceanConnect Marine and Glencore, has been appointed Bunker Manager – Atlantic at Pacific Basin Shipping in London. Tel: +44 20 7182 1050.

Tom Coffey, with LQM Petroleum Services before joining the Cockett Group in London as a senior bunker trader in 2012, has been appointed Branch Manager – Northern Europe.

Lina Molfetas, previously with Poweroil, KPI Bridge Oil London and KPI OceanConnect before joining Shipergy, has been promoted from Senior Trader to Greece Commercial Lead in London. Mob: +44 7873 117 942; Email: l.molfetas@shipergy.com.

Guillermo Sanchez, previously a bunker trader at KPI Bridge Oil and senior bunker trader at Mercuria's Minerva Bunkering in London, has been appointed Sales Manager.

Yusuf Ural, previously a tanker operator for several Turkish companies in Istanbul, has joined Malik Supply A/S in Aalborg, Denmark as a bunker trader. Mob: +45 5210 0443; Email: yhu@malik.dk. **Kristian Haun** has also joined. Mob: +45 6126 6608; Email: kkh@malik.dk.

Hannah Maria Kock, previously a bunker trader at Dan-Bunkering, is now a Risk & Supply Specialist at sister company KPI OceanConnect in Middelfart. Tel: +45 7642 9696; Email: middelfart@kpiocean.com.

After more than 16 years at AP Møller-Maersk, **Mads Ammentorp Stensen** has stepped down as Director and Head of Sustainability in Copenhagen.

Sophus Linnet Raarup, previously a bunker trader with KPI OceanConnect in Middelfart, has joined X Power Trading in Copenhagen as a Global Procurement Trader. Tel: +45 6169 9793; Email: bunkers@xpowertrading.com.

Julie Louise Nielsen, previously with United Fuel Services, Nordic Tankers, Maersk Tankers and Crossbridge Energy before joining StormGeo in Copenhagen as Global Head of Bunker Sales, has joined the board of StormGeo Danmark. Tel: +45 5336 3386; Email: julie.nielsen@stormgeo.com.

Will Owen, previously with OceanConnect Marine in London, Peninsula in Antwerp, GP Global Group and Delta Energy Fuel Supply & Trading in Rotterdam, has joined KPI OceanConnect in Rotterdam as a Senior Bunker Trader. Tel: +31 6 2515 6591; Email: rotterdam@kpiocean.com.

Gonzalo Rivera Bonacasa, previously with Repsol in Singapore and Madrid, and Exxon in Brussels, has joined Maersk Oil Trading in Geneva as a Fuel Oil Trader.

Rustin Edwards, previously with Chevron in Houston and London and Cargill International and Macquarie Commodities Trading in Geneva, has left his position as Head of Fuel Procurement at Euronav to join VKG/TARS in Geneva as Energy Sales Lead.

Christos Doulaveris, previously with China Shipping, Fairdeal Marine Services, Products Shipping & Trading and Monjasa, has joined Bunker Partner in Athens as Trading Manager. Tel: +30 210 008 7360; Mob: +30 69 4608 0374; Email: cd@bunkerpartner.com.

Nikolas Kamilaris has been promoted from Senior Bunker Buyer to Head of Procurement at Shipergy in Athens. Email: n.kamilaris@shipergy.com.

Konstantinos Stefanakis, previously with Coral A.E. and KPI OceanConnect in Greece, has joined Oilmar DMCC in Athens as a bunker trader.


Neslihan Parameritis

Neslihan Parameritis, previously with CYE Petrol and Westbunker Marine Fuels, has joined Bevon Group in Istanbul as Business Development Manager. Email: neslihan@bevon.com.tr.

Two former Peninsula yacht fuel traders have joined the new Hawks Group office, The Hawks Monaco SAM, with **Fabio Scamuzzi** Director of Sales and **Matteo Morciano** Director of Operations.

Mathias Lyne, with Glander International Bunkering in Dubai before joining Peninsula as a bunker trader, has been promoted to Senior Physical Supplier in Gibraltar.

AFRICA & MIDEAST

Rana Jamal, briefly a bunker trader with Overseas Marine Services & Logistics, has been appointed Head of Marine Fuels at Good Bunkers in Port Said, Egypt. Mob: +20 12 0127 9778; Email: Rana.jamal@goodbunkers.com.

Guyson Kang, with Glander International Bunkering in Singapore and Dubai, has left the company.

Awais Ali has joined Global Fuel Supply DMCC in Dubai as a Fuel Supplier. Tel: +971 4577 6537; Mob: +961 54 388 5511; Email: awais@globalfuelsupply.com.

Rakesh Sharma has stepped down as COO at Oilmar Shipping & Chartering DMCC in Dubai.

Sherine Sherif, originally with GAC Group in Egypt before relocating to Dubai to work at Peninsula, World Fuel Services, Aegean Marine Petroleum and Med Petroleum, has joined Oil Marketing and Trading International (OMTI) as International Bunker Trading Manager. Tel: +971 4435 0500; Email: bunkers@oil-marketing.com.

Guillermo Cancela has been promoted to the position of Physical Desk Manager at Peninsula in Dubai. Tel: +971 52 928 9716; Mob: +34 6 6813 1363; Email: gcancela@peninsula360.com.

Jonathan McIlroy, previously with, among others, Aegean Marine Petroleum Network and Al Ghurair Energy, has been appointed Global Commercial Manager at Hawks Energy in Dubai. Tel: +971 4382 7875; Email: uaeoffice@thehawks.biz.

ASIA PACIFIC

Ajit Raikar, previously with Scorpio and SSY in Mumbai before joining GeoServe in Dubai as a bunker trader, has been promoted to Manager – Marine Fuels. Tel: +971 4446 4500.

Jehan Rodrigo, with Prudential Shipping for almost 10 years before joining Lanka Marine Services, has been appointed Assistant Vice President — Head of Commercial and Lubricants at Lanka Marine Services in Colombo, Sri Lanka. Mob: +94 7 7900 8623; Email: jehan.lms@keells.com.


James Stapleton

Dmitry Gerasimenko, previously with LLC Alliance, Best Asia Pacific, Peninsula Petroleum, Sea Oil Petroleum, Bunker Partner and Sonan Bunkers Group, has joined Tuyun Shipping Pte Ltd in Vladivostock, as a bunker trader for the Russian Far East. Tel: +7 91 4666 3666.

Robin Park, previously with Cockett Marine Oil, Glander International Bunkering, ASIA MBS, GP Global Group and Delta Energy Fuel Supply & Trading, has joined GAC Group as Business Development Manager – Asia Pacific Region at GAC Group.

Felicia Sim, at World Fuel Services for 22 years before joining Sing Fuels in 2021, has been appointed Regional Manager of GeoServe Energy Transport in Singapore. **Wilson Tang**, previously with World Fuel Services, KPI Bridge Oil, Unicore Fuell, Sea Oil Petroleum and Sing Fuels, has joined as a Senior Trader.

Sascha Lulla, with Praxis Energy Agents, GP Global and Sing Fuels in Singapore before joining Island Oil, has been promoted to Senior Trader. Tel: +65 6653 1940; Mob: +65 9008 2012; Email: bunkers.singapore@island-oil.com.

Kathryn Ahn, previously with SK Innovation, Singamas Petroleum Trading and Fratelli Cosulich Group, has been appointed Regional Manager – Asia at Oilmar DMCC in Singapore. Tel: +65 6914 9922; Email: bunkers@oilmar.com.

Wei Han Ong, previously with Sing Fuels, has joined Bunker Partner in Singapore as a Bunker Trader. Tel: +65 8299 5064; Email: office@bunkerpartner.com.

AMERICAS

After 10 years at the Plaza Marine Group, most recently as VP Sales and Treading, **John Barbarise** has been appointed Co-Founder and Head of Sales and Product Trading at Ankora Fuels in Deal, New Jersey, joining **Zachary Freedman**, Chairman and **Ross Grill**, Operations & Compliance. Tel: +1 732 993 9700; Email: bunkers@ankorafuels.com.

James Stapleton, previously Director of Marine Sales at Tropic Oil, VP Global Marine at Parkland Marine and Head of Marine Fuels at Poten & Partners, has been appointed Director, Marine Fuels and Freight at Sunoco LP in Newtown Square, Pennsylvania. Email: james.stapleton@sunoco.com.

Anastasia Beliaeva, previously Fuel Coordinator at Carnival Cruise Line and Fuel Purchasing Agent at Carnival Corp., has been appointed Lead, Global Fuel Procurement at Royal Caribbean Group in Miami. Tel: +1 305 539 9562 35362; Mob: +1 305 343 5334; Email: Abeliaeva@rccl.com.

Marc Holm, previously with Maersk Oil Trading in New York and LUKOIL Pan Americas and Hartree Partners in Houston, has joined Trafigura as a Fuel Oil Trader. Email: Marc.holm@trafigura.com.

Monjasa has made changes in its Panama office. **Jonas Bruslund** is now General Manager Latin America (jbr@monjasa.com). **Camilo Ferrand** is Trading Director (caf@monjasa.com). **Rodrigo Acuna** is Trading Manager (rac@monjasa.com). **Sebastian Vasquez** (sva@monjasa.com) and **Jeppe Henriksen** (jeh@monjasa.com) are Senior Traders. **Juan Carlos Valle** is now Operations Manager (jva@monjasa.com).

Marcos Cabral, previously with Shell Oil Company, OW Bunker & Trading, Glander International Bunkering and Bunker One, before a brief stint at Nova Offshore, has returned to Bunker One in Rio de Janeiro and been appointed CFO Brazil.

Felipe Mayrink Chalhoub, previously Bunker Trading Coordinator in Rio de Janeiro and Asia Head of Fuel Oil, Feedstocks and Bunker Trading in Singapore, has returned to Petrobras in Brazil as Fuel Oil & Feedstocks Global Trading Coordinator.

Obituary

PETER MEEUSEN

Peter Meeusen, owner and founder of Inpechem Inspectors BV, and a renowned bunker surveyor, has died at the age of 72, succumbing to Covid-19 while undergoing hospital treatment for cancer in Antwerp.

Peter was a true professional, a great mentor, and a good friend to many. Born in Essen on 26 April 1952, he died on 17 July 2024.

Llewellyn Bankes-Hughes, CEO of Petrospot, remembers: 'I first met Peter at the inaugural International Bunker Industry Association dinner in London on 13 February 1995. I sat next to a wild-haired, bearded, heavily-accented Flemish speaker who was determined that I see and learn first-hand the intricacies of bunkering, fuel measurement and testing in the Amsterdam-Rotterdam-Antwerp region. I was taken on board bunker barges, container ships and oil rigs, to every port, terminal and oil refinery between Rotterdam and Antwerp, and spent days exploring the fuel testing lab that he was so proud of. He introduced me to many bunker suppliers, barge operators and chief engineers, and to his lovely wife Connie. Kind, generous and extremely knowledgeable, I will always consider Peter to have been one of my best and oldest friends in the industry.'

Diary

SEPTEMBER

UK: The Oxford Bunker Course
2-6 September, Oxford
Tel: +44 129 581 4455
Email: info@petrospot.com
Web: www.petrospot.com/events

GERMANY: SMM
3-6 September, Hamburg
Tel +49 40 35690
Web: www.smm-hamburg.com

USA: Argus Methanol Forum
9-11 September, Houston
Tel: +44 207 780 4340
Email: conferencesupport@argusmedia.com
Web: www.argusmedia.com

SINGAPORE: Asian Shipping Decarbonization Summit 2024
10-11 September, Singapore
Tel: +86 132 7191 5990
Email: marketing@ecvinternational.com
Web: www.ecvinternational.com

PANAMA: 9th Latin American Ports Forum 2024
11-12 September, Panama City
Tel: +1 214 272 0296
Email: info@industryex.com
Web: www.latamports.com

USA: Gastech
17-20 September, Houston
Tel: +44 204 551 1602
Email: delegates@gastechevent.com
Web: www.gastechevent.com

SAUDI ARABIA: Saudi Maritime & Logistics Congress
18-19 September, Dammam
Tel: +44 208 052 0508
Email: maritimecustomerservice@informa.com
Web: www.saudimaritimecongress.com

OMAN: Oman Maritime, Ports and Energy Forum
23-25 September, Muscat
Tel: +44 129 581 4455
Email: info@petrospot.com
Web: www.petrospot.com/events

NETHERLANDS: Maritime Decarbonisation, Europe
24-25 September, Amsterdam
Email: tom.kenny@rivieramm.com
Web: www.rivieramm.com

SWITZERLAND: Maritime Transport Efficiency Conference
30 September, Geneva
Tel: +41 22 735 55 30
Email: at@maxcomm.ch
Web: https://mte-conference.com

NETHERLANDS: BunkerExperience
30 September – 3 October, Rotterdam
Tel: +44 129 581 4455
Email: info@petrospot.com
Web: www.petrospot.com/events

OCTOBER

PORTUGAL: SMF Fest
2-3 October, Porto
Tel: +44 129 581 4455
Email: info@petrospot.com
Web: www.petrospot.com/events

SOUTH AFRICA: Africa Oil Week
7-10 October, Cape Town
Tel: +44 203 855 9557
Email: registration@aowenergy.com
Web: https://aowenergy.com

MALTA: Malta Maritime Summit 2024
7-11 October, Valletta
Tel: +3 56 2123 5341
Email: mms@gmint.com
Web: https://maltamaritimesummit.com

SINGAPORE: SIBCON
8-10 October, Singapore
Email: sibcon@informa.com
Web: www.sibconsingapore.gov.sg

UK: Argus Biofuels Europe Conference & Exhibition
15-17 October, London
Tel: +44 207 780 4340
Email: conferencesupport@argusmedia.com
Web: www.argusmedia.com

THAILAND: Oil & Gas Thailand & Thailand Marine & Offshore Expo
16-18 October, Bangkok
Tel: +66 2 513 1418
Email: info@fireworksthai.com
Web: www.oilgasthai.com
Web: www.thai-marine.com

BELGIUM: Marine Energy Transition Forum
22-23 October, Antwerp
Email: info@petrospot.com
Web: www.petrospot.com/events

BELGIUM: Greenport Cruise & Congress
23-25 October, Le Havre
Tel: +44 1329 825335
Email stai@portstrategy.com
Web: www.portstrategy.com

NETHERLANDS: ARACON 2024
24-25 October, Rotterdam
Tel: +44 129 581 4455
Email: info@petrospot.com
Web: www.petrospot.com/events

NORWAY: Maritime Hybrid, Electric & Hydrogen Fuel Cells Conference
29-31 October, Bergen
Email: info.london@rivieramm.com
Web: www.rivieramm.com

NOVEMBER

UAE: ADIPEC
4-7 November, Abu Dhabi
Tel: +9 712 444 4909
Email: adipec.enquiry@dmgevents.com
Web: www.adipec.com

GREECE: IBIA Annual Convention
5-7 November, Athens
Tel: +44 203 951 9615
Email: ibia@ibia.net
Web: www.ibiaconvention.com

GERMANY: European E-Fuels Conference
6-7 November, Hamburg
Tel: +48 616 46 9780
Email: hubert@acieu.net
Web: www.wplgroup.com

UK: LNG Shipping & Terminals Conference
12 November, London
Tel: +44 20 8364 1551
Email: info.london@rivieramm.com
Web: www.rivieramm.com

USA: LNG Bunkering North America Summit
18-20 November, Fort Lauderdale
Tel: +44 207 368 9300
Email: enquire@iqpc.co.uk
Web: www.oilandgasiq.com

GERMANY: The Motorship Propulsion & Future Fuels Conference
19-21 November, Hamburg
Email: corporate@mercatormedia.com
Web: www.motorship.com

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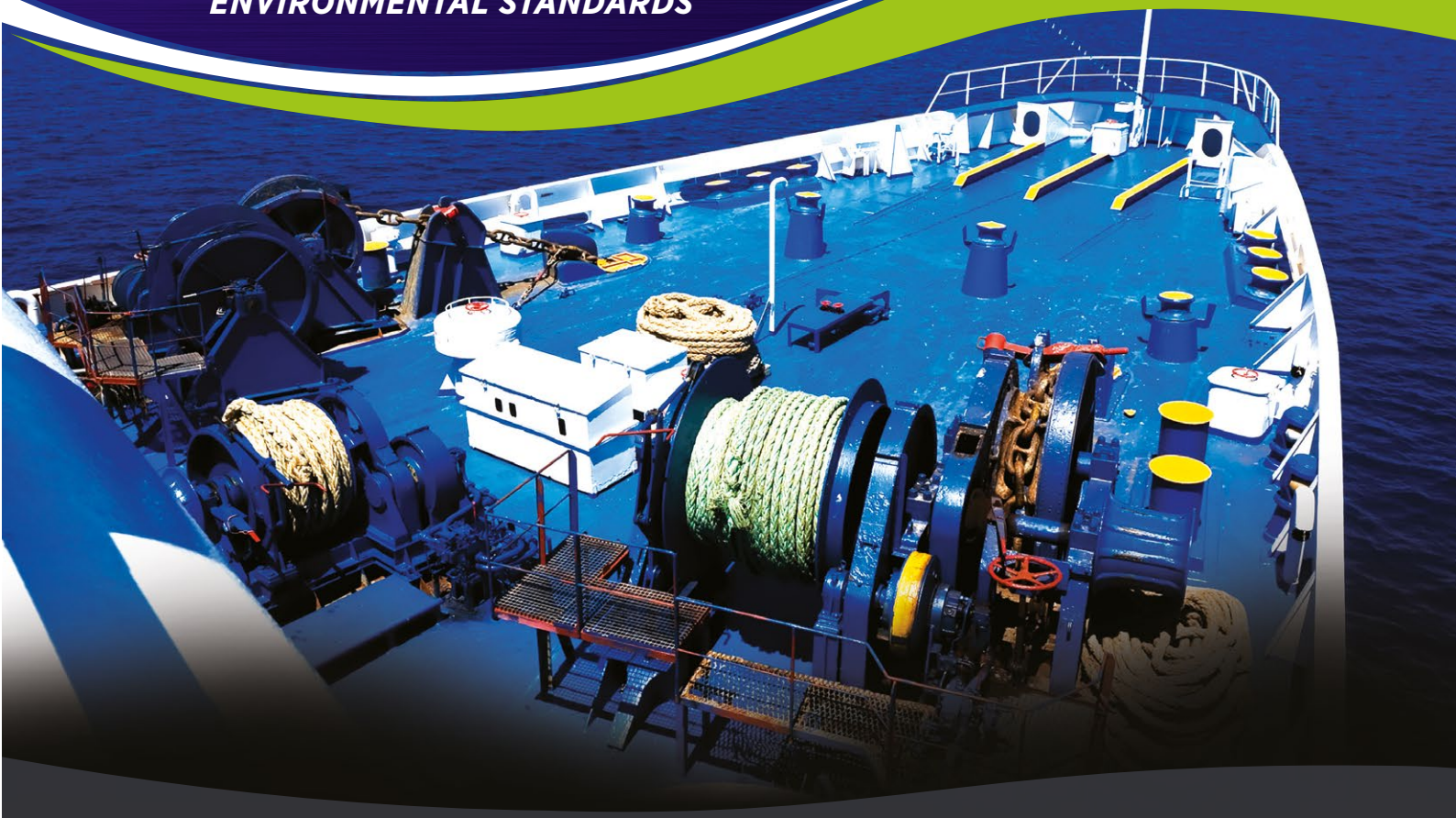

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