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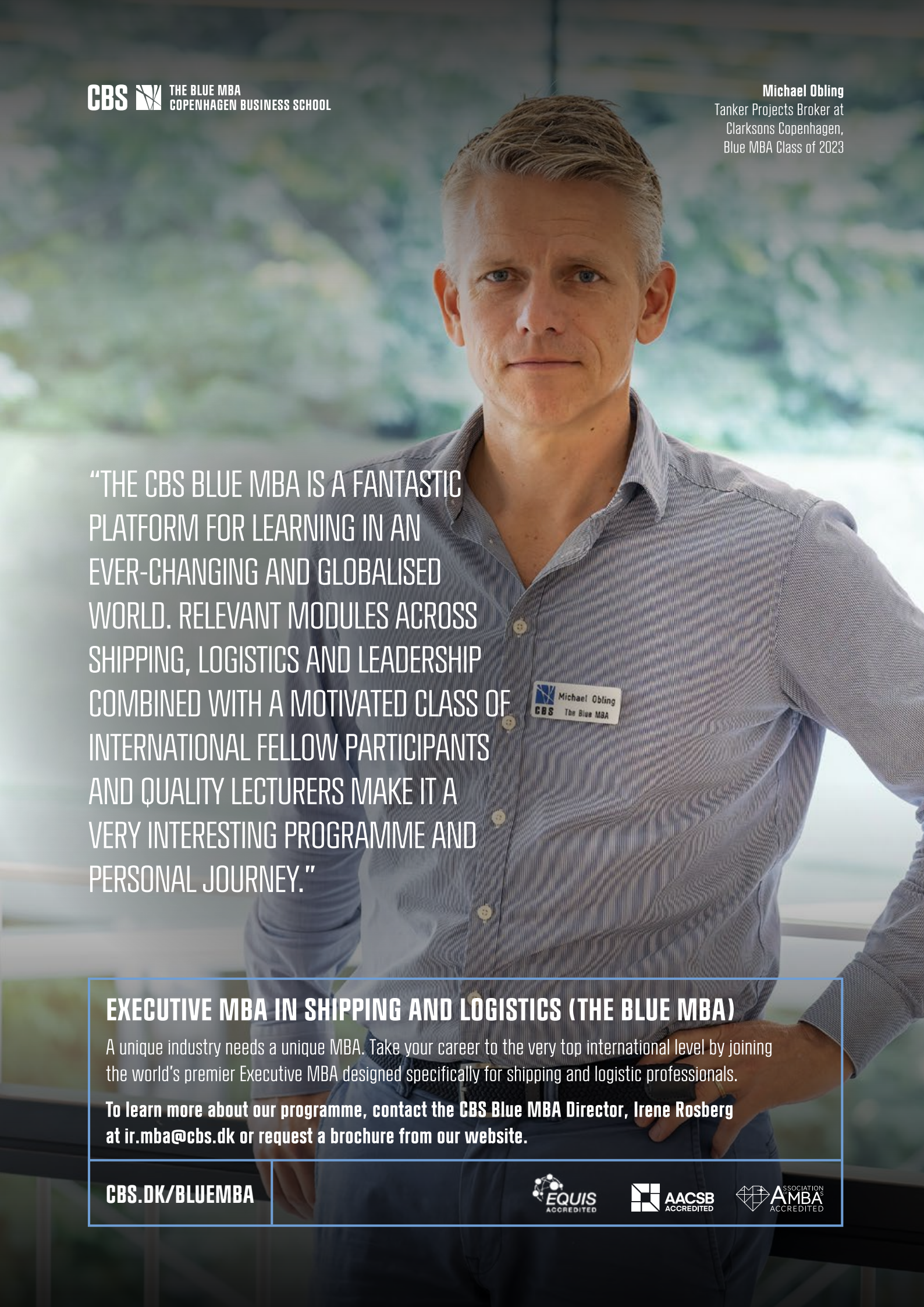
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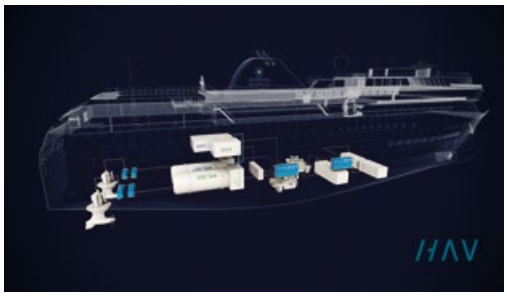
Contents

OPENING

TANKER OPERATOR ATHENS

DECARBONISATION



TECHNOLOGY

OCIMF: enclosed space workshop, 6 months of SIRE

OCIMF held an enclosed space fatality workshop; it published 9,926 inspection reports in the first 6 months of SIRE 2.0; plus other guidelines and meetings. Highlights of its Feb-April newsletters

OCIMF held its fourth enclosed space fatalities workshop in London on March 27 with representatives of 32 industry associations including INTERTANKO, IOGP, InterManager, IPTA, SIGTTO and IACS.

Fatalities due to asphyxiation and poisoning in the shipping industry continue, despite numerous rules, regulations and best practice guidance on how to avoid such deaths, OCIMF said.OCIMF did an analysis of incidents, including of the vessel type, incident location and rank and role of the victim. It identified Performance Influencing Factors (factors that make errors more likely) which occurred in many enclosed space entry incidents. Recurring contributing factors included operational, commercial, technical and training related issues.

The working group agreed that the maritime industry does not need new procedures relating to enclosed space entries.

The working group is committed to deepening its understanding and sharing its learnings with the wider industry, with the intention of helping organisations identify and improve these factors to prevent incidents.

The working group requests that shipping companies share information about any enclosed space incidents to enclosedspaceaccidents@intermanager.org, including the approximate date, the ship's name and a brief description of the accident. Information gathered will be kept strictly confidential.

The group plans to develop and implement a standardised ISO recognised enclosed space symbol and advocate this to the IMO; to develop and publish a booklet for maritime staff that addresses the human factors and highlights the dangers of enclosed spaces.

Also to develop training videos for shore-side personnel highlighting risks of unintended commercial and operational (time) pressure being put onto ship's staff; and to develop training videos for non-mariner shore-based personnel coming onboard a vessel, highlighting potential dangers of enclosed spaces.

Six months of SIRE 2.0

Over the first six months of SIRE 2.0, 9,926 SIRE 2.0 inspection reports were published.

OCIMF is providing additional training and support to its inspectors in the assessment of human factors.

User feedback on SIRE 2.0 has been addressed and refinements have been made to improve clarity and consistency in reporting, OCIMF said. SIRE 2.0 Quality Assessors are working to standardise reports.

INTERTANKO meetings

OCIMF attended INTERTANKO's Nautical Sub Committee (NSC) and Human Element in Shipping Committee (HEiSC) meetings in Athens on 19 and 20 March respectively.

Discussions at the NSC included:

Anchoring joint industry working group – recommendations for strengthening anchoring winches and fittings to withstand deeper water anchoring and more adverse environmental forces.

Fujairah Anchorage reorganisation – safety concerns around anchoring depths and reduced anchorage space.

GNSS interference – wrongful operation of GNSS receivers remains a key concern that could result in a major incident.

Weather routing systems – some concerns around competence of weather routing operators (training and experience).

Pilot Ladders – IMO Sub-Committee NCSR's approval of revision of SOLAS reg V/23 to improve the safety of pilot transfer arrangements and mandatory performance standards.

Discussions at the HEiSC included:

Seafarers Initiative – three workstreams targeted at attracting and retaining talent, including tanker operator top-up training and transition to shore.

IMO STCW Review – INTERTANKO's active participation, including cooperation with OCIMF (co-sponsorship of submissions).

IMO STCW Review Training for Alternative Fuels – including experience requirements (bunkering and watchkeeping) and the usage of simulators.

Best security practises

BIMCO, ICS, IMCA, INTERCARGO, INTERTANKO and OCIMF, supported by over 40 maritime stakeholders, released the consolidated and enhanced Best Management Practices (BMP) for Maritime Security, in an online publication. It consolidates previous regional editions of the BMP into a single document.

It provides a threat and risk management process and signposts to direct users to the most up-to-date security intelligence and risk assessment information.

https://www.ocimf.org/publications/

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SPM Hawser guidelines

The second edition of OCIMF's Guidelines for the Purchasing and Testing of SPM (Single Point Mooring) Hawsers has been published, with guidance on the specification, purchasing, testing and design particulars of mooring hawsers.

The second edition includes rope design particulars and documents, including the Offer of Hawser Form and the OCIMF Compliance Certificate, ensuring rope manufacturers, purchasers and inspectors have the latest guidance and information.

Seafarer wellbeing panel

OCIMF was invited to InterManager's seminar focused on seafarers' wellbeing, held in London on 29 January 2025.

A panel from OCIMF, the Seafarers Hospital Society, Rightship, Philippines Transmarine Carriers and InterManager had a discussion on theme of "The Future of our Industry – How to Deal with Current Challenges of Recruitment, Enclosed Space Deaths, Lifeboat Accidents, and Criminalisation".

OCIMF presented its cross-industry work on enclosed space incidents. For lifeboat accidents, it published an information paper, "Management of Survival craft on Fixed/ Floating Offshore Installations" in December 2023.

OCIMF has no active work specifically related to seafarer recruitment and criminalisation of seafarers, but does recognise that these challenges have an impact on its members and the larger maritime community.

Piracy growth

The 2025 Q1 report on Piracy and Armed Robbery Against Ships released by the International Chamber of Commerce's International Maritime Bureau (IMB) recorded a total of 45 incidents, a 35 per cent increase with the same period of 2024, OCIMF reported.

There was a spike of incidents in the Singapore Straits.

Of the incidents reported, 37 vessels were boarded, four were hijacked and four had attempted attacks. The threat to crew safety remains high with 37 crew members taken hostage, 13 kidnapped, two threatened and one injured, OCIMF said.

The number of incidents in the Gulf of Guinea continues to be at its lowest in TO

Explaining MEPC 83's fuel emission intensity regulation

IMO made a big decision at its MEPC 83 meeting in April about how fuel emission intensity will be regulated. LR and DNV experts explained more, including how you should approach it, and other decisions made

Fuel emission intensity is about the emissions your fuel makes per unit of transport work it does. It is calculated as "grammes of CO_2 equivalent per megajoule". It is a different measure to counting your total emissions.

Maritime regulators have brought in fuel emission intensity regulations because they see it is necessary to push for the adoption of low emission intensity fuels, as well as push companies to reduce total emissions. An easy way to reduce total emissions is to put your company out of business, which is not what governments want to see.

FuelEU Maritime is also a fuel intensity regulation, which will run in parallel with this one.

The mechanism chosen by IMO is very complicated. Your emission intensity will need to reduce every year, so the world fleet meets the targets set by IMO for coming decades. But IMO did not set one target, it set two – to map to the "at least" reduction and the "striving for" reductions set in 2023. In its 2023 meetings, delegates did not agree on how much and how fast shipping should decarbonise.

These targets were that total annual GHG emissions from international shipping will be reduced by at least 20 per cent, striving for 30 per cent, by 2030. And then reduced by at least 70 per cent, striving for 80 per cent by 2040. Both compare to 2008.

To add to the confusion, IMO has given the targets non-intuitive names of "base" and "direct", with "direct" target being the tougher one.

If you miss the "base" target you'll need to pay $380 per tonne of CO_2 equivalent emitted; if you miss the "direct" target you'll pay $100 per tonne of CO_2 equivalent emitted, and have the option to trade with a company which has done much better than the direct target.

The term "CO_2 equivalent" is used because we are not just talking about CO_2. We are also talking about methane emissions, emitted in producing the fuel and from the ship; and nitrous oxide. These both have a bigger greenhouse gas impact per gramme than CO_2, and so their emissions are adjusted to put them in "CO_2 equivalent" terms counted per gramme.

The amount individual vessels will need to reduce, in order for the world fleet to meet the target, will depend on how much fuel is used for vessels in the world. For this reason, the specifics of what this means for fuel intensity have only been defined up to 2035.

There was also much discussion at IMO about what is achievable bearing in mind low carbon intensity fuels are not yet widely available. Delegates aimed to find a balance between being ambitious and being realistic.

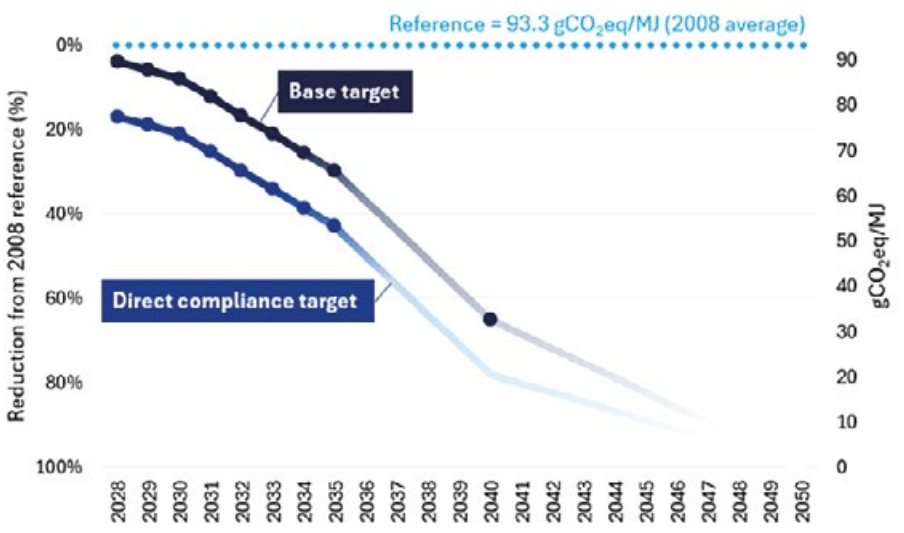
More details

The baseline (starting point) is 93.3g CO_2 equivalent per megajoule, decreed to be today's average emission intensity of maritime fuels.

Then for each year from 2028 to 2035, vessels need to reduce their average fuel intensity over the year to a level less than that, shown in an IMO graph.

Another new piece of jargon: a ship which achieves the base target but not the direct compliance target is considered "Tier 1 non-compliant."

The regulation applies to all ships over 5,000 GT, with the exception being ships operating in the waters of their flag state, ships not using mechanical propulsion, and oil and gas vessels which do not move (floating storage / production units and rigs). DNV's Eirik Nyhus believes it is likely to reduce to ships over 400 gt "in the not-



Year	2028	2029	2030	2031	2032	2033	2034	2035
Base	4%	6%	8%	12.4%	16.8%	21.2%	25.6%	30%
Direct	17%	19%	21%	25.4%	29.8%	34.2%	38.6%	43%

How emission intensity needs to reduce over time, with two separate targets, "base" and "direct". Image courtesy DNV

too-distant future".

The emissions intensity of a fuel is calculated based on the emissions made in producing the fuel as well as combusting it on a ship. The emissions made in producing the fuel and delivering it a ship are known as "well to tank" emissions. The emissions made specifically by a ship engine are known as "tank to wake" emissions.

It is important to count the "well to tank" emissions because they can vary a great deal. For example, producing ammonia fuel has very different emissions whether it is made from renewables (green), fossil fuel with carbon capture (blue) or fossil fuel without carbon capture (grey).

All fuels incur well to tank emissions, including from agricultural harvesting of biofuels, refining of hydrocarbons, and transportation.

IMO's standards to date, EEDI, EEXI and CII, only cover the tank to wake emissions.

Companies using shore power (if from renewables), wind power and solar power can use this to improve their fuel intensity figure, because this is zero emission fuel, and so will reduce the average fuel intensity of the ship.

DNV estimates that the entire maritime industry will need 25m to 30m tonnes oil equivalent of net zero fuels by 2030, to ensure the whole fleet can reach the base target, about 10 per cent of shipping's total energy use.

FuelEU maritime regulations will exist alongside these – so ships calling at EU ports will need to pay the costs associated with both, if emissions do not fit the threshold.

The full impact of the IMO rules, according to DNV's Tore Longva, is "significantly more stringent than Fuel EU Maritime," particularly for 2030.

EU has declared that it will review overlap between Fuel EU Maritime and IMO regulations and if they need to change their regulations as a result.

The mechanism

Marine fuel suppliers will calculate the emission factors of their fuel production and submit it to flag states for approval. They will provide the emission factor data to shipping companies buying the fuel on a "fuel lifecycle label".

Then, ships will use this data to calculate the average fuel intensity of fuel used throughout the year, considering how much of each fuel type was used.

Ships not meeting the targets will need to purchase "remedial units". To meet the base target, remedial units can only be purchased from an IMO registry at $380; to meet the "direct" target, remedial units can be purchased from the IMO registry at $100, or bought from a shipping company which did better than the target and so banked a "surplus".

Presumably online auction platforms will be developed, as we have seen with FuelEU Maritime. The agreed-on price will be some function of supply and demand, the true costs of decarbonising, and a ceiling of $380 (because if the traded price is higher, companies would purchase instead from the IMO registry).

Shipping companies have an option to bank their surplus compliance to use later, but this surplus will expire after 2 years.

There will be a central administrative office operated by IMO to issue the remedial units, manage a 'bank' of surplus units, and record the transfer of surplus units between ships. All ships will pay a fee (not yet known) towards its administration costs.

If a ship has a deficit, it could fill it partly by purchasing units from IMO and partly by purchasing them from another ship.

When a surplus unit is issued, the purpose or destiny needs to be decided at that point.

Revenues to IMO from sale of the remedial units have been estimated at $10bn - $15bn revenue a year, but it is hard to predict without knowing how many ships will choose to buy them rather than reduce fuel emission intensity.

Payment will be the responsibility of the ISM Document of Compliance holder. Ships will of course seek to be reimbursed for any payments by their charterers. But the agreement to do this must be included in charter parties. Regulators will not assist shipowners in getting reimbursed by charterers.

Illustration

Andy Wibroe, lead regulatory specialist, with Lloyd's Register provided the following illustration.

If your ship's current greenhouse gas fuel intensity (GFI) is 70 g CO_2 equivalent/MJ in 2028, you are better than both the base and direct targets. You have a surplus which you can sell.

By 2031, your emission intensity is better than the base target but not enough to reach the 'direct compliance target'. So, you are "Tier 1 non-compliant". You need to purchase "remedial units" from IMO at $100 a tonne, or from another company which has made a surplus (or from your own company, if it has banked any, including from earlier years).

By 2034, your emissions are worse than both the base and direct trajectories. You becomes "Tier 2 non-compliant". You will need to purchase "remedial units" for $380 a tonne from IMO. You cannot buy them from another shipping company.

Rewarding net zero fuels

The regulation has a mechanism for rewarding use of net zero / near zero greenhouse gas fuels, called ZNZ in the jargon.

This connects with IMO's 2023 goal "that the uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources are to

represent at least 5%, striving for 10%, of the energy used by international shipping by 2030."

The threshold for what counts as a ZNZ will initially be 19 g CO_2 equivalent/MJ and subsequently reduce to 14 g CO_2 equivalent/MJ in 2035. The threshold will be reviewed every 5 years.

So, it can include fuels which make no emissions like ammonia, wind assisted propulsion, solar power, and possibly onboard carbon capture and storage, if it reaches the threshold.

Ships can receive a reward, paid from the sale of remedial units, for their use of ZNZ. The lower the fuel intensity, the greater the reward, although the minimum will be 19.

Timeline

The regulations enter force in March 2027. The fuel certification schemes will be recognised over March-April 2027. The specific fuel "pathways" will be certified in Autumn 2027.

Also in Autumn 2027, ships will submit an amended Ship Energy Efficiency Management Plan (SEEMP) showing how they will collect data about fuel efficiency, which needs to be approved. They also open an account with IMO's GFI registry.

Ships will start collecting data about fuel use over the 2028 calendar year. They will first submit data for verification and compliance review in early 2029.

Then every year from 2029 onwards, ships will send their reports for the previous year in Jan to March, see it verified by the recognised organisation over April to June. In July ships will select how they will fill any deficit or allocate any surplus units. In August, the registry will issue an account statement to verify they have enough units. The recognised organisation issues a statement of compliance in September.

Guidelines will be issued about how to include the plan in the SEEMP, how fuel GHG intensity will be calculated for different fuels, how the GFI is verified, how to open and manage an account with the registry, how to certify a fuel, how to determine rewards for using ZNZs.

Your fuel intensity strategy

You should start planning for this by calculating your current fuel intensity, to get an idea of how much you need to reduce it by, advises Jack Pringle, global head, energy transition advisory at Lloyd's Register

Then, look at the various levers available, such as using biofuels, or retrofits to use alternative fuels. For each possible pathway you can calculate the improvement potential and the economic case.

Your fuel procurement strategy should consider the expected supply and demand of future fuels, their production costs, and the achieved emission intensity.

Zero carbon fuels are unlikely to be available on an open market in unlimited supply, as current maritime fuels are, for some time. Instead, companies may want to make long term arrangements with a supplier, perhaps in partnership with other shipping companies to aggregate purchasing power.

You may want to look at use of energy saving devices onboard. These have no direct impact on fuel intensity, but are important indirectly, because companies will need to use more expensive alternative fuels, so will be looking harder for ways to cut consumption.

Then, build your "compliance pathway". Companies might choose a pathway with the minimum cost, or a pathway with the biggest commercial flexibility and efficiency.

As an illustration, an Aframax tanker burning 6,000 MT heavy fuel oil a year will be in deficit as soon as the scheme starts in 2028. By 2040, its deficit will be 15,000 tonnes CO_2 equivalent.

If it does nothing to switch fuels, the total cost of purchasing remedial units between 2028 and 2040 will be $34.2m, almost as much as the $40.5m fuel bill. Total costs are $74.7m.

If it switches to a blend of 30 per cent biofuel, the vessel now makes a surplus from 2028 to 2031, exceeding both targets. From 2031 it misses the "direct" target, and from 2034 it misses the "base" target. Over the period to 2040, the fuel cost rises to $55.9m, and the cost of remedial units drops to $13.1m. Total costs are now $69m. "So B30 is a strong measure for 3-4 years but not a long-term solution," Mr Pringle said.

But if the proportion of biofuel in the fuel gradually increases from 30 per cent to 100 per cent, and energy saving devices are used, the total costs can reduce by $11.2m, plus 6,700 units are available to sell. This is based on the current cost of biofuels, and $3m spent on ESDs, achieving a 10 per cent fuel saving.

In this case, according to LR's model, $60.3m is spent on fuel, $0.2m spent on remedial units and $3m spent on energy saving devices, so total costs now $63.5m. This model also generated surplus units valued at $2.6m based on $380 per tonne CO_2, leading to total cost of $60.9m.

Other MEPC developments

MEPC also discussed CII. It was supposed to have its first review completed by the end of 2025, including to establish reduction rates for 2027 to 2030. The April 2025 MEPC meeting decided that the reduction rate would increase from 2 per cent a year to 2.625 per cent a year.

There were hopes that some "flaws" in CII would be rectified in this meeting, such as where companies can reduce their score while actually increasing emissions, such as by sailing a longer distance empty. Work to fix this will start in 2026 to finish in spring 2027. "The hope that we would have CII fixed in 2025 turned out not to pan out, to put it very bluntly," said DNV's Eirik Nyhus.

"Some people talked about sunsetting the CII. I'm not convinced it will happen. It is a topic of discussion at least."

There have been tweaks to the data collection systems, with strengthened anonymisation, to ensure commercial secrets are not leaked. The definition of "underway" has changed.

The guidelines for measuring greenhouse gas emissions other than CO_2 have changed, stating it is acceptable to use test bed and onboard measurements for methane and nitrous oxide.

If companies believe their methane slip is better than IMO's default value, they can do onboard measurements of it and submit that.

Mr Nyhus hopes that EU will do the same under EU ETS and FuelEU Maritime.

The topic of onboard carbon capture and storage "has been rolling around for a while at IMO," he said. "We have a workplan agreed for developing a regulatory framework. We don't have decisions yet."

There is a new Emission Control Area in the North Atlantic, extending from around Greenland to the south coast of Spain. From 2028, vessels will need to limit sulphur in fuel to 0.1 per cent.

There is work on a legally binding framework for control and management of ships biofouling. A draft should be ready in 2028. "This will be a very significant regulation. There is agreement that it will be developed. So, this one matters a lot."

There is a review of NOx Technical Code to certify engines using non carbon containing fuels.

There will be development of guidelines for management of ammonia slip from ammonia engines.

Between now and October 2025, not much is likely to happen. "The regulatory framework is approved, its sitting there, it's been circulated, you don't touch significant elements of that before adoption," Mr Nyhus said. "Pricing, reduction rates are not up for discussion. I think this is going to go through." TO

This article is based on webinars about MEPC 83 from Lloyd's Register on Apr 23 and DNV on Apr 24. To watch the webinars online, for Lloyd's Register go to www.lr.org then "knowledge" "view all knowledge" "podcasts and webinars". For DNV go to www.dnv.com then "insights", "shipping," "webinars".

Decarbonisation by Norwegian shipowners

Norwegian tanker operators Odfjell, Torvald Klaveness, Solvang, and Utkilen provided updates on their decarbonisation projects, including suction sails and onboard carbon capture

Chemical tanker operator Odfjell has already spent $40m installing 140 energy saving devices on its fleet of around 80 vessels, said Erik Hjortland, Vice President, Technology, Odfjell Ship Management. It has another 50 projects in the pipeline, to be done by 2030. All of the devices chosen provide a return on investment in under 2 years.

The company is particularly keen on propeller boss cap fins and Mewis ducts. They are "cheap and they work," he said.

Erik Hjortland, Vice President, Technology, Odfjell Ship Management

Mr Hjortland has been leading decarbonisation at Odfjell for 18 years, focussing on operational improvements since 2007 and technical improvements since 2014.

Mr Hjortland said he "cannot stress enough" the benefit of hull and propeller cleaning. $1 on cleaning can save $15 of fuel," he said. For each ship, "we save 3.5 tonnes of fuel per day."

It has seen big benefits from weather routing to the extent that the average "sea state" encountered by vessels in a voyage reduced from 3.5m waves in 2008 to 0.6m waves in 2021, he said.

Now, the company is testing wind assisted propulsion, which means that it is seeking windier routes rather than avoiding them (because high wind means bigger waves), he said.

Odfjell recently installed four suction sails on its vessel Bow Olympus. The sails only took 3-4 hours to properly mount on the vessel.

They are used together with an AI based weather routing system.

For the first voyage it "delivered above expectations," he said. Preliminary figures showed a 20 per cent fuel saving. And the weather conditions for wind are normally better when sailing across the Atlantic in the other direction (West to East).

Odfjell is not so keen on green fuels (from renewable electricity) due to the high production losses.

If you have 1 KWH of green electricity, you lose 30 per cent when producing hydrogen, and a further 30 per cent when using the hydrogen to make the fuel, he said. A further 50 to 60 per cent of fuel is lost in the engine. So, the whole process means an 80 per cent energy loss.

"This we find problematic," he said. "This is bad energy economics."

"This is why we find sails better. You harness wind power already on the ship - that is a wise use of resources."

The suction sail technology was chosen based on having a lower weight than some other solutions, the price, payback time, ease of use by crew, and ability to get a positive effect with wind at different directions compared to the ship direction. "We might test other wind technologies," he said.

If it is proven to definitely work, the company plans to deploy it across the fleet, he said.

It will also provide big benefits under FuelEU Maritime. "If you have a sail on a ship, you don't have to buy biofuel on that ship and 2 other ships until 2031, and very little until 2034," he said.

The only operational data Odfjell gathers from ships for use in analysis is the noon report, he said. It is "good enough, believe it or not."

In 2015, the company developed a business intelligence tool, to compare the performance of vessels in its fleet, identify best practise, measure the impact of energy saving devices and services, and see where to best direct its focus.

It has a software 'robot' which analyses company data, to detect when a vessel may be using more energy than it should do. It generates about one hundred alarms every day. Odfjell has a team of staff which analyses the alarms and works with the crew. "This is very efficient," he said.

The company recently undertook a project to reduce consumption of boilers on its ships. For the highest consumers in the fleet, it could reduce consumption by 50 per cent; for 19 ships, it could reduce it by 20-30 per cent. The average saving was 20 per cent.

But reducing fuel consumption beyond around 53 per cent, without using zero carbon fuels, "will be really difficult," he said.

The company was not so successful with air lubrication, which was installed in one ship in 2023 and tested for a year. "Unfortunately, this did not work for us," he said. The company is not sure exactly why it did not work, but there may have been interference with another energy saving device.

Another less successful experiment was using a solid oxide fuel cell to generate power, which turned out to be too expensive.

Torvald Klaveness

The maritime industry normally requires an order book equivalent to 15 per cent of the world fleet to be on balance, given the time between making the order and receiving the vessel, and an expectation of gradual growth of the world economy, says Ernst Meyer, president and CEO, Torvald Klaveness.

Today the order level is at 10-12 per cent for bulkers and tankers. "You can question if we are able to provide enough vessels," he said.

And we also expect the world fleet to need to grow about 40 per cent from now to 2050 due to general economic growth.

"According to my prognosis we need 40 per cent fleet expansion from now to 2050 while getting rid of all carbon," he said. Meanwhile, shipping companies need to move to much more expensive zero carbon ships.

The decline of coal shipping from the maritime market will relieve some pressure, but that will be offset by growth elsewhere,

Ernst Meyer, President and CEO, Torvald Klaveness

such as for shipping increased amounts of food and metals, he said.

There is enormous inefficiency in shipping if you look at the market as a whole, he said. It is common to see two vessels passing each other mid ocean, both empty. We also see vessels going fast to "clock demurrage," or compensation from the charterer because the vessel is ready for cargo, but the cargo is not ready for the vessel.

There are many inspections done in ports which could have been done virtually, he said.

To move forward, the industry needs better ways to exchange data and knowledge, he said.

One way that the maritime industry can get more out of its vessels is by ordering more combination carriers, like those Torvald Klaveness operates.

The company owns and operates 16 combination carrier vessels which can carry both liquid and dry products. They are sized between 72,000 and 83,000 dwt, with three more on order for delivery in 2026.

More widespread use of these vessels in shipping could lead to the number of ships travelling empty ("ballasting") by 10-15 per cent, he believes.

Mr Meyer anticipates that the total potential for shipping to reduce fuel consumption with energy efficiency, including sails, air lubrication and Mewis duct, is about 15 per cent. But maybe 20 per cent of the world fleet will ever do it. So, it is not much of a solution on a global basis.

Companies can improve efficiency by 3-5 per cent by voyage optimisation.

Trading efficiency, by comparison, could achieve much bigger gains, he said.

Ships could also make much better use of their cheap satcom systems introduced over the past few years. "We do many things on vessels that could have been done by people onshore, such being prepared for port calls."

We still see inspectors using their finger to check if a hold is clean enough for a cargo, which could be done with automated systems, he said.

"We want digital platforms between cargo owners and shipowners to do more."

Shipowners should also be aware that there could be macro changes to the commercial environment. People have got used to the idea of shipping being a timing game, where freight rates go up and down over decades due to the pace of newbuildings or vessel retirements, and the challenge is picking the right point in the cycle to build.

But this may no longer be the case if vessels do not have an economic lifetime of 25 years, because of future decarbonisation requirements making vessels ordered today turn into stranded assets.

The shipping industry has also got used to working in a deflationary environment, with costs getting cheaper and cheaper. The shipping industry "has not faced inflation ever," he said. The "tariff war" initiated by the US may cause big changes to this.

Solvang – the first carbon capture onboard

LPG and petrochemical tanker operator Solvang is operating the world's first full scale onboard carbon capture system, explained CEO Edvin Endresen.

The system has been installed on an ethylene carrier "Clipper Eris," which sailed from Singapore to Europe on February 17, 2025. It aims to capture 70 per cent of the CO_2 in the exhaust from both the main engine and auxiliaries.

On its first voyage, the system could capture 60 per cent by the time it got to Cape Town, he said.

It is technically possible to capture more than 70 per cent of the CO_2, but it would require much more energy, he said. It can get on a path to net zero by using a blend of 20 per cent zero emission fuel.

The 70 per cent capture rate can also be achieved largely using heat already available from the ship's engine, so there is only a 15 per cent increase in vessel fuel consumption.

For now, there is currently no facility on shore anywhere to accept the CO_2 for sequestration (permanent storage in the subsurface). So, the CO_2 is being vented to the atmosphere. But it proves that it is possible to separate CO_2 from the exhaust on an operating vessel, and the CO_2 can be discharged to shore facilities for storage once they are available.

Solvang will also be testing systems to liquefy and cool the CO_2 onboard, so it can be stored onboard in a tank until it reaches a reception facility.

Plans are underway to take the CO_2 to a reception facility in Rotterdam, where it could be stored in the future Porthos carbon capture and storage plant (expected to be in operation in 2026), used as fertiliser for an industrial greenhouse, or used in a chemical process to make a new material.

If the CO_2 is going to be utilised (rather

Solvang's "Clipper Eris" with a CO_2 capture system and CO_2 tanks onboard

than disposed of), then there is no need for a special license under the London Protocol (which addresses movement of waste products by sea).

The system can switch on quickly, he said. So, it can work as soon as the exhaust is in stable state, such as when the vessel is on an open sea crossing.

Solvang has had exhaust gas recirculation running on "several vessels" for about a decade, taking a portion of the exhaust to the engine's air intake. This can reduce Nox emissions. This has the added benefit of making the emitted exhaust much higher concentration CO_2, which reduces the work which needs to be done by the carbon capture system, he said.

The system was developed by Wärtsilä and tested for three years before installation, at its facility in Moss. Wärtsilä developed a full-size replica of the shipboard system. There was a Wärtsilä staff member onboard the Clipper Eris.

The company chose to experiment with onboard carbon capture because it sees all the alternative means of achieving decarbonisation as difficult, such as e-fuels, ammonia, biofuels, and batteries.

If you use renewable energy to make an e-fuel, "about half the energy is gone."

And there are 90,000 vessels in the world today burning conventional fuel.

Solvang is itself a major transporter of ammonia, so is familiar with handling it on a ship, but also recognises "it is a really difficult product to handle."

The big question is how to get the world ready for ships capturing their own CO_2. To make it a viable option, you would need infrastructure available around the world to accept CO_2 from vessels and deliver it to a sequestration site. You would also need regulation to make it financially worthwhile, he said.

Utkilen and decarbonisation

Chemical tanker operator Utkilen is decarbonising through converting vessels to LNG fuel, doing high quality hull cleaning, fitting bulbous bows and Mewis ducts on vessels, and rebuilding gear systems. It is also looking at sails and batteries.

The company operates 15 chemical tankers, all made from stainless steel, operating in the Baltic Sea. Each vessel typically makes a port call on one day in three. Customers include Equinor, SLB, Chevron and YARA.

Utkilen announced in December 2024 that it had upgraded one chemical tanker (built 2019) to operate on LNG fuel, "Mostraum". The vessel had been built to be ready for dual fuel, with an "LNG-ready" engine. In 2024 it also launched an LNG dual fuel newbuild, "Listraum". Utkilen plans to retrofit three more vessels to operate on LNG in 2025.

It seeks to maximise flexibility of operations in its newbuilding plans, said Jarle Hillestad, Head of Ship Management.

It has challenges persuading its terminals to fit shore power infrastructure, due to concerns about building connectors for high voltage electricity when they are also working with dangerous chemicals. But "shore power is coming hopefully sooner rather than later."

It is doing high quality hull cleaning, which is leading to full savings of "probably 5-8 per cent," he said. "Before, if the hull wasn't green we were happy."

Other energy saving measures include fitting bulbous bows and Mewis ducts on vessels, and it has a project to fit a sail on a vessel.

It is installing battery power systems.

The bulbous bow design can be used on an ice tanker, he said. "You can build whatever [you want] as long as you build it strong enough."

It is rebuilding gear systems on ships to optimise vessels for lower speeds. Older vessels were designed to operate at 14-16 knots, but today 11-12 is more usual, he said. A new gearing system can keep the engine operating at its most efficient revs per minute, while the ship moves at the most commonly used speed.

The fuel saving resulting from all of this is between 4 to 21.7 per cent on its ships. But the ships seeing the biggest savings are probably the vessels which were least efficient to begin with, he said, or have not yet had the most useful modifications, such as with gears and bulbous bow.

Jarle Hillestad, Head of Ship Management, Utkilen

Utkilen is interested in finding ways to extend the acceptable lifetime of vessels. It is common for companies to "scrap vessels which are perfectly good."

But older vessels sometimes prove to be more fuel efficient (and have a better CII rating) than the newer ones, indicating that the older vessels were built to a good design, he said.

Something seems to have improved in quality for vessels built around 2000 – there were big challenges with vessels built in the 80s and 90s, such as with structural defects seen in later years, he said. But a vessel built in 2000 still has ballast tanks in good condition today, he said.

There has not been much advance in engine automation over the past decades, but there have been advances in what is done to improve the engine, such as with turbochargers and gears, he said. And "information sharing between ship and shore is a completely new world."

Utkilen has invested in rebuilding accommodation on its older vessels, to "ensure people onboard have a good work and living environment."

The company is watching Solvang's onboard carbon capture project closely, Mr Hillestad said.

Norwegian Shipowners Association

IMO's MEPC 83 meeting set a historical decision. Although "We should have had the decision 10 years ago," said Knut Arild Hareide, CEO of Norwegian Shipowners Association.

"As a former politician I know it is easier to set a goal than achieve a goal."

"I hope we will find an economic mechanism. A tax will be the right start of this regulation," he said.

Previously, Mr Arild Hareide was Director General of Shipping and Navigation at the Norwegian Maritime Authority. Before that he had a political career, including as Norwegian Minister of the Environment from 2004 to 2005 and Minister for Transport from 2020 to 2021.

Mr Arild Hareide visited Buenos Aires in 2004 as Norway's minister for the environment to the Buenos Aires Climate Change Conference. He was told to defend Norway's shipping industry. "I said, 'that's very easy, you can say it is impossible to do anything'".

But now we have seen that it is possible for shipping to do something, he said.

TO

Columbia COO – how SIRE 2.0 is evolving

SIRE 2.0 was introduced in September 2024, which means that most ships have now done multiple inspections. Captain Leonid Zalenski, chief operating officer of Columbia Ship Management, presented his experiences

"It is the beginning of SIRE 2.0," said Captain Leonid Zalenski, chief operating officer of Columbia Ship Management, speaking at the Tanker Operator Athens forum on April 2.

"It worked quite OK. There are areas we can improve; we are all adjusting ourselves."

Since the system went live on Sept 2, 2024, most ships were now undergoing their second inspection at the time of the conference (Apr 2, 2025).

When SIRE 2.0 started, there were no vessels rejected by screening departments for a couple of months. But this has since changed. The data now shows that the number of vessels being rejected by screening is similar to under the previous system, he said.

SIRE 2.0 is generating resistance because it is something new, people are being audited about something for the first time. "It is a challenging process," he said.

Captain Leonid Zalenski, chief operating officer of Columbia Ship Management,

There was a similar feeling of resistance when the ISM code was introduced, or when SIRE system was implemented in 1993, he said. People had to accept they could no longer do things in their own way, and instead follow a standard process, assessed to have the lowest risk.

When the SIRE system was introduced initially, in 1993, "it was something completely unknown, and unusual. But it brought the standard up. I am sure this system will bring the standard up."

Familiarity with processes

The main benefit for shipowners and managers is the enhanced focus on the human element, in particular the familiarity of frontline personnel with procedures and rules.

"This will no doubt make the industry safer," he said. "If people would always follow rules and regulations we would have much less incidents."

The majority of incidents on ships are related to the human factor, and human factor incidents are often related to compliance with procedures. The process was not being followed, or the process was not clear or robust enough. But people normally only learn this after the incident, Captain Zalenski said.

At company crew seminars, he tells crew they should consider what will happen to their families if they have an accident at sea, then tells them that following procedures is the best way to reduce the risk of this.

The processes and procedures in ships have all been developed after safety incidents and disasters, just as SOLAS was brought in after the Titanic disaster.

"If people realise and understand that following the procedures and processes will make them safer, they will improve a lot. But we are human beings, we tend to cut corners, and often we consider procedures are for inspectors."

Crewmembers are selected by shipping companies based on formal qualification confirmed by a certificate of competency and interview results.

Under the SIRE 2.0 regime, crewmembers' familiarity with processes and procedures is also assessed regularly which enhances compliance culture and as a result will assist to reduce the number of incidents caused by lack of compliance or deviation from safety practices, he said.

Purpose is screening

At the same time, tanker operators should remember that the fundamental purpose of SIRE 2.0 is to assist oil company screening departments in working out if it is safe to charter a vessel. SIRE 2.0 is not primarily to help shipping companies manage their own safety.

Oil companies have decided they need to manage risks themselves, rather than rely on class or regulator to do this. You do not need to agree with them, but you need to accept it do business with them, he said.

If all flags took a consistent approach, in ensuring the ISM code was being followed, and there were class societies monitoring the technical condition of the vessel up to expected level, there would be no need for SIRE. "Life would be much easier, standards would be much higher, and the number of incidents would be reduced," he said.

But energy companies need to manage their own risk, and this is the main reason why SIRE system was introduced on the first place. SIRE is a commercial inspection regime designed to manage charterers' risks and assist in their decision-making process.

There are commercial implications to a shipowner if a vessel is rejected by charterers. The last thing any safety manager wants to hear is that the fixing of a vessel is being held up for vetting reasons.

The results of every SIRE inspection are uploaded to SIRE system and are available for screeners of different energy companies. SIRE reports are valid for screening for 6 months and in order to prevent SIRE to become overdue inspections are typically carried out every 4-5 months.

Oil companies do not use the same screening criteria. One company may charter a vessel which another has rejected, based on the same inspection results.

OCIMF itself does not decide about the acceptance of a vessel for business. This is always a decision of a screening company, depending on their own risk appetite.

This makes it different to the RightShip organisation. RightShip uses inspection results and other relevant data available publicly and assigns safety scope based on their own algorithm, leaving decision to charter a vessel to the screeners. RightShip inspections are completed (for eligible vessels) using similar inspection questionnaire and inspection results are affecting the safety score.

SIRE inspections can be made while the vessel is doing different activities, such as loading, discharge, bunkering or idle. Some oil companies treat these inspections as equivalent; other oil companies only accept inspections made while the vessel is discharging, he said.

Some oil companies are also doing inspections outside SIRE system. For example, oil companies Repsol and CEPSA inspect every vessel which operates at their terminal. They sometimes ask operators if they want it to be a SIRE or non-SIRE inspection, the difference being that a SIRE inspection will see data uploaded to the SIRE system.

Background to SIRE

SIRE, the "Ship Inspection Report Programme," was first introduced in 1993 to address concerns about safety of tanker operations. There had been a number of incidents happening with tankers, although they were all in class and had ISM certificates. Something more needed to be done to screen out the bad performers.

SIRE involved inspectors going through a standard Vessel Inspection Questionnaire (VIQ). The results of inspections were uploaded to a common database where they could be accessed by members of the Oil Companies International Marine Forum (OCIMF).

Screeners would normally only accept an inspection report under 6 months old.

"It is a very transparent system," Mr Zalenski said. "This was working for many years; it did the trick. I personally do believe [safety] improved significantly. The standard of operation on the tanker fleet went up. The number of incidents reduced significantly, especially pollution incidents, which at that time was the main concern. Everything was going in the right direction."

VIQ went through a number of revisions since 1993, with the seventh revision, VIQ 7, launched in Feb 2019, and used until Sept 2, 2024.

The weakness was that the industry reached the point where everybody was meeting the standard. "As with any system, people got used to it," he said.

If a ship had a negative "observation" it would be for something minor. Ships with more than two such negative observations were considered to have a disappointing result. And safety was not improving any further.

Background to SIRE 2.0

So OCIMF started planning a new system in around 2020, which it called "SIRE 2.0", including a new questionnaire. It took 5 years to develop.

It was previously planned to be released in 2023. "It was delaying and delaying. This was an absolutely good thing for the industry, because OCIMF was not ready, shipping companies were not ready," Captain Zalenski said.

SIRE 2.0 was trialled within OCIMF, then trialled with selected companies, and then saw a third stage of trials which any company could participate in, but where the results would not be used in any screening decision. Then finally it was released in Sept 2024.

Stylianos Chatzikaplanis, Vetting Manager, Chandris (Hellas) Inc

The goal of SIRE 2.0 was that the inspection would provide more accurate information and enable better judgement about the quality and future performance of the vessel.

It would become possible to focus more on the significant risks, better address emerging technological and regulatory changes, focus more on how the vessel is being managed and enhance governance controls.

An important part of SIRE 2.0 is the increased focus it puts on the human element. The previous version of SIRE, in contrast, was about technical matters and the vessel physical condition.

Human factors become more important as the industry faces a shortage of qualified crewmembers, which makes it harder to maintain high standards, he said.

SIRE 2.0 would also have a better connection with TMSA. The previous version of SIRE used to run in parallel with TMSA, without any interaction between them.

The SIRE 2.0 questionnaire

SIRE 2.0 has a completely different vessel inspection questionnaire. Instead of asking a standard set of questions, the questions are grouped into core questions, rotational questions, conditional questions, and campaign questions. The questions are linked to items in the TMSA system.

The software generates a "Compiled Vessel Inspection Questionnaire" for each inspection, including all core questions, a random selection of rotational questions, and conditional / campaign questions as required.

The inspector has the list of questions to answer on this tablet computer, including how much time should be spent on each question. The inspector also needs to take photographs and move around the vessel.

Questions assigned "core" are based on the most important risk factors, so they are asked every time.

There are two sets of rotational questions, set one and set two, which are lower risk factors.

"Conditional" questions depend on what the vessel is doing, and information submitted in the pre-inspection questionnaire (PIQ).

For example, the ship is asked if it does cargo, ballast, bunkering and mooring audits in the PIQ. If it says yes, it will get questions about these to check how they are being done.

These audits are included in stage 4 of TMSA. Ships are not required to be at stage 4, but if they claim to be at stage 4, they should also say they do them in the PIQ.

The system will ensure questions fit the type of vessel, so gas tankers get questions relevant to gas tankers.

"Campaign questions" will be adjusted over time if oil companies identify specific areas of concern. During this period, every campaign question will be a core question, assigned to every inspection.

For each question, there can be answers relating to hardware, related processes, and crew familiarity with these processes.

The inspector is obliged to interview a certain number of people and check their familiarity with processes.

Questions in SIRE 2.0 do not have straight yes or no answers.

For every item, the answer is graded "as expected" (which was previously a simple "yes"); "exceeding expectation" which is considered a positive observation; "largely as expected" (which means there is not enough grounds to say "no", but it is a potential non-compliance), or "not as expected", equating to "no" in the previous system.

Negative findings are printed in red font in the report, as with the previous system. With the new system, positive observations are printed in green font.

The "largely as expected" is "practically not used" by inspectors, he said. Inspectors are still mainly choosing between yes or no, "as expected" or "not as expected."

The "not as expected" is similar to a non-conformity under the ISM code, stating something is not right.

Pre-inspection workload

From a tanker operator's perspective, SIRE 2.0 means that the workload around inspections is significantly bigger. "We had to employ a couple of additional people," he said.

The pre-inspection phase of SIRE 2.0 is now "completely different to what we used to have," he said.

You need to complete the Pre Inspection Questionnaire and Vessel Particulars Questionnaire, and provide a set of photographs, vessel certificates, and a class status report.

You need to give the inspector minimum 48 hours to review the documents. It may be much more time than this if a vessel is not able to

enter the berth at the expected time.

With the previous system, it was possible to arrange an inspection at very short notice.

A ship can get negative observations if the inspector is not satisfied that the photographs meet requirements, such as because they are taken from the wrong angle, or did not capture the correct equipment.

Counting observations

The industry is still discussing the best way to benchmark and analyse inspection results. Assessing a vessel overall based on the number of observations is easy but may not make much sense.

Within the industry, there have been inspections with no observations and inspections with forty observations, he said. It is obviously better to have less observations. But from a screening perspective, it is important to look at what the observation is about.

A single observation about a high-risk item can lead the oil company to decline all vessels from the entire fleet. It is clear which questions relate to the highest risk factors because they are the 'core' questions, he said.

And ten very low risk observations can still mean the vessel has a very low risk. For example, there can be observations because of inconsistencies between data provided in the PIQ and data submitted elsewhere, which are clerical errors.

There can be multiple observations about the same problem. In one example, the inspector considered that a certain process was not sufficiently covered by a procedure. The inspector went on to make an 'observation' of a 'performance influencing factor' relating to the human element, stating that the observed person was not familiar with the procedure, which he had previously stated did not exist. There may be more observations because of other crewmembers not familiar with the procedure which does not exist.

If performance must be compared, it may be better just to count observations relating to core questions, he said.

Coffee break at the Tanker Operator Athens forum

Audience at the Tanker Operator Athens conference

Inspection quality

Some inspectors are focusing on procedures, something which is normally assessed during TMSA review. This generates additional observations, which are not always justified. This is not fully in line with the goal of SIRE 2.0 where focus is expected to be on safety of the operation and effectiveness of procedures implementation.

"Inspectors are still adjusting themselves to the new system. It is much easier for them to record the observation related to the process than to do anything else."

A core aim of SIRE 2.0 was to remove inspection subjectivity, so a vessel would always get the same inspection outcome with any of the four hundred OCIMF inspectors. "But in actual fact, the way it works right now, it's extremely subjective," he said. "We have to deal with it."

"I do not like this subjectivity, but I cannot change it. I am not protecting the approach of oil majors. I am trying to explain why we have this system and why it works."

The subjectivity should reduce through better training of the inspectors, "The quality of [inspector] training is not up to our full satisfaction," he said. "OCIMF also agreed with that, and they are dealing with that. It will adjust, to some extent, pretty soon, I believe. Then we will have an equal approach during the inspection."

Meanwhile, the reports can still provide "a certain understanding of how the vessel is operated," whether it gets five observations or fifty-five, he said.

Positive observations

Inspectors can record positive observations when something is particularly good.

Positive observations can be useful for shipping companies to identify high performing crewmembers and recognise their performance. "In the majority of reports, we have one or two positive observations," he said.

But it does not usually make much difference in the vessel screening decision. Vessel screeners "simply don't have time to read positive observations."

"When they read the SIRE report they focus on negative observations. It is fair enough. They say, 'if you have one high risk observation and five positives, it is not a formula five minus 1 and positive observation does not offset the negative one. If the vessel has high risk observations screeners will reject the vessel.'"

INTERTANKO inspection data

In INTERTANKO data of 827 inspections, there were 5503 negative and 151 positive observations.

Of the negative observations, 37 per cent were for process; 34 per cent for human, 23 per cent for hardware and 6 per cent for photos.

Captain Zalenski noted that SIRE 2.0 was not intended to be primarily an inspection system for process, but it may be turning out that way. "Process is leading the show."

One commonly seen observation from inspection of INTERTANKO members is that an audit report does not include the auditor's name. This should be easy to fix.

When analysing the observations per VIQ chapter, the biggest, 34.5 per cent, were from chapter 5 on safety management. "No surprises there," he said.

The second highest was for chapter 2, "certification and documentation," 18.7 per cent. Common areas for issuing a "performance influencing factor" observation were "custom and practise around the process" and "regulation of safety criticality of tasks."

"It is easy for inspector to allocate a PIF to one these categories," he said. TO

Watch the talks on video and download slides **at www.tankeroperator.com/ath2025.aspx**

SIRE 2.0 experiences at Arcadia

Capt. Apostolos Skempes, HSQE Manager, DPA and Training Manager with Arcadia Ship Management, explained how SIRE 2.0 differs to the previous version from a ship manager's perspective

When Arcadia first started thinking about SIRE 2.0, Capt. Apostolos Skempes, training and HSQE manager, saw it as something the company was forced to do by its customers.

Now he sees it as a vast improvement on the previous inspection system, and a good step forward. But it is "a bit more challenging," he said, speaking at the Tanker Operator Athens forum on April 2.

"We are still in the first year, we have to be patient."

The inspection process can help the company to understand if its systems need any changes, or if any training needs to be done.

It forces companies to make their procedures more comprehensive and ensure that crew understand them.

For example, companies have always had procedures for operating, inspecting, testing, and maintaining their inert gas systems.

With SIRE 2.0 they also need procedures for the associated equipment, including boiler uptake valves, scrubbers, demisters, blowers, and gas regulating valves. These procedures need to include operation, testing and maintenance.

Similarly, the SIRE 2.0 inspectors review company procedures to ensure "all lifesaving equipment" is tested and ready for use.

If this includes everything in SOLAS III/36, it means that all lifesaving equipment should have easily understood instructions, an inspection checklist, maintenance and repair instructions, a periodic maintenance schedule, a diagram of lubrication points and list of recommended lubricants, a list of replaceable parts and a list of sources for spare parts, and a log of inspection and maintenance records.

"We see that we are forced to add a lot to our procedures," he said.

This means procedures become much more complicated, as words and phrases are added to them to cover the requirements. The company had been trying to simplify its procedures over many years, but this is no longer happening.

Maybe things are going too far with the detail, he suggested. For example, perhaps the instructions in a manufacturer's manual could be treated as the company procedures, rather than having to retype them into the company's procedure documents. But an inspector may not accept this.

Submitting data pre-inspection is quite an administrative burden. Since most of the data is already available in other software, such as Q88, it should be possible to build software tools which can automate the work, he suggested. Currently the OCIMF software does not support integration.

More specific questioning

The questionnaire on the previous version of SIRE did not ask much about company procedures. In SIRE 2.0 questionnaires, 82 per cent of questions refer to company procedures.

In the previous version of SIRE, the questions to crew were asked in a fairly generic way, such as "to start the emergency fire pump."

Now it us much more specific, stating that an officer or rating should describe the use and wearing of self-contained breathing apparatus, or an officer or rating should demonstrate the opening of a door from inside without any key.

For oil tankers, there are about 180 questions which may be asked of master and deck officers, including forty-five for engineer officers. There are forty-five questions which may be asked for ratings.

The word "interview" was not included in VIQ 7. But the SIRE 2.0 questionnaire uses it many times, "interview one officer and one rating."

Seafarers need to be able to show the inspector they know what the policies are and how they apply to their daily tasks, and the inspector will need to find out if they are doing it.

With the previous SIRE, a shipping company could arrange for the inspector to meet only the most competent crewmembers. The rest could be conveniently unavailable.

But this is no longer possible, because "there are questions for everybody. Everyone should be ready to be interviewed," he said.

On the plus side, this means that "everybody becomes competent," he said.

Crew can be nervous about being interviewed, even those who are very experienced, he said. It is something new for them. "They are competent, many years in the rank, but losing it in front of the inspector. We have seen that."

Some crewmembers are not so confident in their English language.

An inspector's approach to the interview

Capt. Apostolos Skempes, HSQE Manager, DPA and Training Manager with Arcadia Ship Management

is critical, for the outcome, he said. Some inspectors only ask one question strictly; some tell crew members they should take their time in thinking of their response.

Today's seafarers are different in many ways to seafarers of previous generations. "It is not that traditional seamanship has gone away or been lost, I would say it has been changing," he said.

Some inspectors have given positive observations when they see something they particularly like.

Arcadia often gives a personal bonus to any crewmember receiving a positive observation. The promise of bonuses can motivate crew to study more. "I'm very happy about that," he said.

Training

Every ship has a computer where ratings can sit down to read and get familiar with policies and manuals. But you need something more to help them get familiar with them.

Arcadia is providing ratings with copies of questions they might be asked and the right answer.

"To just give them a piece of paper is not enough," he said. "We ask the officers to assist and check ratings with the knowledge.

Officers also need to learn the answers to questions they might get asked.

Any company has to consider whether to bring in consultants to help with training, or to use training software tools, or OCIMF tutorial videos.

"SIRE 2.0 puts everybody back to school, studying, getting prepared. Most people have had to study for exams at some point in their lives, and it is similar to this. We have to do our homework with SIRE 2.0."

Tanker Operator Athens discussions

Discussions at the Tanker Operator Athens forum included whether SIRE 2.0 makes life for seafarers too complicated, the relationship with TMSA, and whether it focuses on the right issue

Making procedures too complicated

A critical question for SIRE 2.0 is whether it forces procedures to get too complicated to understand, said Dimitris Lyras of Lyras Shipping, chairing the conference.

It could mean that highly competent seafarers get marked down because they do not have an in-depth knowledge of the procedures of their current vessel.

"If the captain has no idea how this [inspection] is going to turn out, it is not a good thing," he said.

An ideal manual would explain to crewmembers why procedures on the ship they are working on may differ to a procedure they already know, Mr Lyras said.

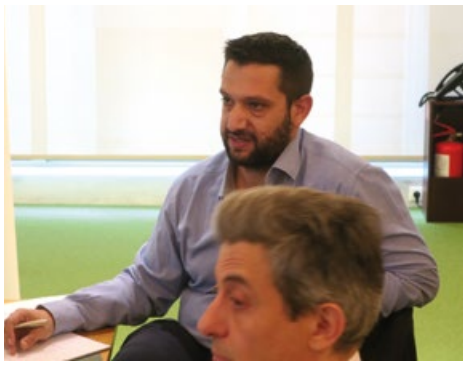
Captain Zalenski replied that a good manual should be one which is "user friendly, clearly structured and gives users easy answers to the questions."

"I strongly believe, if you want to be successful, we need to make compliance easier for the user," he said.

There is a difference between "accepting the procedure exists" and "the procedure being intuitive," added Captain Skempes from Arcadia.

Many shipping companies were given advice by their TMSA auditor that their processes might be too complicated and include some repeated references.

If you try to include every bullet point of the vessel inspection questionnaire in your manuals, you might end up with too many pages for anyone to work with.



Cpt. Stylianos N. Mourtzanos, Eurotankers

Captain Zalenski and Captain Skempes tak questions from the audience

"We see consultants are coming and offering some tools and a way to structure our systems based on these requirements. All this is welcome," he said.

TMSA and SIRE 2.0

While SIRE 2.0 questions are built in close alignment with TMSA, there are important differences between the systems.

In a TMSA audit, the auditor checks you do everything you have said you do in your submission. They may give you advice on how you can reach a higher level.

SIRE 2.0 is stricter, with the inspector giving tanker companies an observation if they do not have what is asked for, Captain Skempes said.

TMSA encourages companies to continuously improve, with better procedures and following industry best practise.

But SIRE 2.0 is more binary, with an "observation" being made if you do not reach the required level.

While TMSA audits make suggestions, the vetting does not. When an inspector is asked what he has seen in another vessel, he replies, "I am not allowed to make suggestions," Captain Skempes said.

The TMSA review is based on companies being asked to demonstrate their procedure for something and provide evidence, Captain Zalenski added. SIRE 2.0 results could provide this evidence, if TMSA auditors wanted to look at them.

Audience comments

One audience member noted that SIRE 2.0 inspections ask similar questions to ISM inspections. "When I was a second mate I had my first ISM inspection from a class organisation. ISM was the most difficult inspection."

"The surveyor was coming onboard, asking me to show him the company's procedure and present evidence that I am following it. Exactly what SIRE 2.0 is asking now."

One audience member noted that SIRE 2.0 pushes companies to focus on the details. But as a result, they may put less attention on the big picture, that the industry has a major problem finding sufficient competent seafarers.

TO

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Managing the risk of ship-to-ship providers

6 per cent of global ship-to-ship transfers are associated with incidents, says STS data provider DYNAMARINe. The incident rate for vessels registered with DYNAMARINe is 1.8 per cent. Here's how the risk can be managed

The average incident rate for ship-to-ship transfers with tankers is 6 per cent, said Alexandros Glykas, CEO of STS risk management data provider DYNAMARINe, speaking at the Tanker Operator Athens forum on April 2.

However, for DYNAMARINe registered vessels, the risk of STS incidents is 1.5 per cent for the year 2025 of transfers.

The biggest cause of incidents in a ship-to-ship cargo transfer is mooring lines breakdown, at around 70 per cent of all incidents, he said.

The next biggest causes of incidents are fender breakdown, damage by tug or supply boat, vessel collision, transfer hose breakdown and oil spill on deck.

Some STS Service Providers consider a mooring line failure as a "near miss" rather than an "incident," because it does not necessarily lead to any spillage or loss, he said. Service providers should follow the incident categorisation already in place by SOLAS and OCIMF guidelines.

Tanker companies typically work with STS service providers contracted by energy companies in order to manage the transfer, guide the crew, and provide equipment, such as hoses and fenders, he said.

STS companies providing services to DYNAMARINe registered vessels know that data about their performance will be recorded, and so often aim to provide a better service in order to avoid delays, thus provide better quality equipment, he said. This leads to a lower incident rate.

Risk data

In general, the bigger the vessel, the more ship to ship transfers it will do. So, the vessel type with the most transfers is the VLCC, followed by Suezmaxes, Aframaxes and handysize.

77 per cent of Aframaxes will participate in a ship-to-ship operation at least once in their life.

However, the number of incidents per ship type does not relate to the number of transfers; there are more incidents with Aframaxes, Mr Glykas said.

"The vast percentage of incidents are related to high-risk service providers," he said.

Data shows the highest incident rate is in West Africa, "due to the large number of substandard service providers," he said. However High-Risk Service Providers exist in most STS regions globally. The risk categorization of STS Service Providers is a transparent process available to all users.

For example, some service providers do not replace their hoses as often as they should and utilise cargo hoses whose lifespan could be extended up to 10 years. Over 30 per cent of cargo hoses are over 4 years old, and some STS Service providers provide hoses 7-8 or even 10 years old. "In our operations we advise our clients to reject such hoses them," he said.

STS operations where oil majors are involved have a better safety record than STS operations on behalf of oil traders, as you might expect, since oil companies have some level of quality vetting criteria.

Complex stakeholder relations

One cause of safety challenges is the complicated relations between stakeholders, including the master of the vessel, STS service provider, cargo owner, charterer, flag, P+I, technical operator, and ship owner.

Not all the stakeholders have direct agreements, for example the STS service provider has a contract with the cargo owner or vessel charterer but not the shipowner.

So, risk can be reduced by making sure that vessel operators apply risk-controlled measures at each STS operation based on available data and furthermore that they apply assessment procedures that their vessels comply with OCIMF STS recommendations and the approved STS Plans

STS provider data

DYNAMARINe has data about all STS service providers, including an understanding of the operating systems, competency, and equipment. It does audits of their actual STS operations, or their management systems.

It has rated the risk level of every provider, in a transparent process, he said.

DYNAMARINe will shortly start working with approved and trained external auditors from classification societies to do gap assessments on STS providers.

In this way, DYNAMARINe will have a process to evaluate STS Service Providers on a global scale with the aim to reduce the number of audits sustained by STS service providers. At a later stage such audit data is planned to be shared with OCIMF members and INTERTANKO.

Alexandros Glykas, CEO, DYNARMINe

It will train Classification society inspectors, who are normally ISM auditors, to do STS audits and gap assessments on its behalf, following OCIMF criteria in its STS Service Provider Management and Self-Assessment (STS SPSA).

There are three STS forums around the world which collect data, and DYNAMARINe is linked to them.

About DYNAMARINe

DYNAMARINe STS Service was founded in 2010 and was restructured in January 2024. Currently the company is at the fourth design of its risk data system.

It does audits of STS service providers and also provides training for seafarers and shore operators.

It has data about 1100 vessels in its system for whose they do the risk management at each STS Operation, in about 4000 STS permits per year.

It receives data about vessel locations around the world from two AIS providers. This provides good insight about where ship-to-ship transfers are taking place.

During 2025 DYNAMARINe STS Data will be shared with EQUASIS for transparency and simplification of logistics from energy companies for DYNAMARINe registered vessels.

It has been involved in over 50 claims so far, some relating to P+I (injuries, cargo loss, collisions, and pollution), and some for hull and machinery, and some for delays.

It works with insurance underwriters, who need its data to calculate the risk of a voyage which includes one or more ship to ship transfers.

TO

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Learning from Höegh about ammonia

Höegh Autoliners is ordering vessels which can be converted to run on ammonia when the fuel is available and market supports it. It may be creating a pathway for the tanker industry to follow

Höegh Autoliners of Oslo is taking delivery of 12 "Aurora" car carriers over 2024-27, the last four of which, delivered in 2027, will be built to run on ammonia from the start.

The first eight are being built to run on LNG, with the possibility of conversion later to ammonia, when the market supports it. The first four vessels may be converted to run on ammonia in 2029.

The vessels will also be able to run on heavy fuel oil as a back-up.

The vessels already have many other efficiency saving measures, cutting emissions by 58 per cent per car transported compared to the current industry standard, Höegh claims.

As well as running on LNG, the vessels have 1500m2 of solar panels on their top deck. They do not have wind propulsion for vessel stability reasons. Wind propulsion "is better for vessels with a centre of gravity below the water line," said CEO Andreas Enger.

When the company started planning its new fleet in 2020-21, it was researching a vessel design that could be viable for a 30-year lifetime. Its objectives at the time were to renew the fleet, strengthen the balance sheet and serve shareholders. It needed an energy transition plan, to avoid the risk of stranded assets.

This led to an objective of making vessels which could be converted to run on ammonia. Although it did not anticipate any of the vessels would be built with ammonia engines.

This has changed, as ammonia engine technology has matured, "ourselves pushing on [engine manufacturer] MAN".

Höegh is "totally dependent on its partners" when developing a pathway to alternative fuels, he acknowledges.

Andreas Enger, Höegh Autoliners ASA

"The most important thing we are doing is showing that this is possible."

Ammonia challenges

The ammonia tank proved "the most difficult thing to do something about," he said.

The company chose to install an LNG tank classed for use with ammonia. Although ammonia is easier to handle than LNG, because it does not need such low temperature.

If you want to fill the LNG tank up with ammonia, you do not need to change any of the piping between the tank and the engine.

It is not possible to retrofit an ammonia tank on a car carrier, because the only place to put it would be the top deck, which would make the vessel unstable.

The biggest safety concern is engine room safety and the bunkering process, where there is potential for leakage. But "it is not establishing a fundamental risk that is new to global shipping."

Höegh's ships will be able to decarbonise at whatever speed the market dictate.

It would be possible for half of Höegh's fleet to be completely carbon neutral by 2030. But that would require more customers willing to pay for ammonia fuel in 2030. "We don't think it will go that fast," he said. "Speed is determined by the market."

"If we are to solve the climate challenge we have to do it with cost effective technologies. You can't assume people will idealistically do it," he said.

Ammonia supply

Mr Enger is sceptical about companies who say they are concerned about the supply of ammonia fuel, believing it is just an excuse for inactivity. Making fuel supply a problem is a "construction designed to slow down the process."

Ammonia supply will be scaled if demand is there, he believes. "The notion it can't is ridiculous."

Höegh does not have a view about whether the ammonia should be green or blue (made from renewable electricity or gas with carbon capture).

Having a "blue route" is a factor making ammonia more cost efficient and scalable, because blue ammonia supply is likelier to be available in bigger volumes earlier.

There are also many other uses for renewable electricity which ammonia production competes with, and blue ammonia has less competition.

However, "we don't believe limitation of (supply of) green fuel is going to be long lived," he said.

Companies choosing methanol fuel, which is not a zero carbon fuel, are doing it because "it is cheaper and easier," he says. Höegh's previous series of newbuilds, built in 2016, could have been promoted as "methanol ready", because methanol can be stored in conventional fuel tanks. The company did not promote them in this way, he said.

Ammonia suitability

There are some factors of ammonia engines which make them particularly suitable for car carriers and for Höegh, many of which also apply to tankers.

"What we see is ammonia seems to be better suited for large vessels spending most of their life on long sea voyages," he said. Ammonia also seems better for engines running at low revolutions per minute (RPM).

For vessels mainly making short sea voyages running at higher engine speeds, "it seems to have more challenges," he said.

The value of Höegh's cargo (cars) is high compared to the value of most bulk vessel cargoes, so the extra fuel cost is a lower proportion of the total delivered product cost.

And the end customer (car drivers) are often environmentally conscious, so car companies will appreciate being able to say they have been shipped across the ocean without emissions.

It is easier to implement ammonia fuel on ships if you have full control of crewing and technology on the ships, as Höegh does. "Many things in our operation make it easier for us to do what we are doing."

Ammonia fuel seems unlikely to be suitable for cruise shipping due to the additional safety risks from having thousands of people onboard.

Finally, ammonia fuel is only suitable for companies with high safety standards. Engine manufacturers may be reluctant to provide an ammonia engine to a shipping company they have less confidence in, because one accident could destroy the whole market, he said.

AET using DNV's CFD analysis

Tanker operator AET has been working with DNV to find the best decarbonisation option for each class of ship in its fleet. AET's goal is to reduce GHG emissions by 40 per cent by 2030.

DNV did the study using Computational Fluid Dynamics (CFD), which basically means making a digital simulation of how the hull will move through water, at different speeds and draughts.

The data is then combined with operational data from DNV's Abatement Insights database, to understand the full effect of the technology on the vessel's emission and fuel efficiency performance.

DNV was able to develop a dashboard for each vessel, providing an overview of its technical profile, operating patterns, fuel consumption, emission performance, and return from decarbonisation investments.

You can see the projected greenhouse gas performance for each vessel relative to IMO trajectories, with and without different energy efficiency measures.

AET can use the information to plan capital expenditure, plan logistics, and see what carbon reductions and fuel savings it will make. It can prioritise investments and plan modifications around dry dock schedules.

"This year we have close to 14 vessels docking. We'll install propeller boss cap fins on the first four ships, pre-swirl ducts on five, and apply antifouling and ultra-low-friction coatings to seven or eight ships," said Sobhith Hariharan, Head of Decarbonization at AET.

Decarbonisation measures are seen in three tiers.

The first tier is "foundational technologies," such as propeller boss cap fins, pre-swirl ducts and advanced coatings. These deliver immediate savings, perhaps 5 per cent per vessel, according to the studies.

The second tier is more ambitious technology such as wind assisted propulsion. Given these projects cost more and take more time, they need more careful evaluation.

The third tier is fuel retrofits and other "transformative technologies". An example is AET signing newbuild contracts for three ammonia dual fuel Aframax tankers in 2024.

TO

Study: LNG via fuel cell to power a ship

A Norwegian research consortium is exploring the idea of vessel propulsion by LNG put through a fuel cell to generate power, while capturing CO2 and putting into tanks for later discharge

Could the future of maritime propulsion be LNG routed through fuel cells to generate electricity, the CO_2 taken out and liquefied, and later offloaded for permanent subsurface storage?

A research group in Norway "LNGameChanger" believes it may be. A special aspect of the scheme is that the offgas from the fuel cell can only include CO_2 and water, so there is no complex CO_2 separation (capture) process to operate on the ship. Water and CO2 separation is a straightforward process, which can be done by cooling gas to liquid.

This is because only oxygen is able to go through a membrane to react with the gas, and only the amount of oxygen which is needed.

Compare this to the conventional way of looking at onboard carbon capture and storage, where the fuel is combusted in air in a ship engine. The flue gas might be 10 per cent CO_2. This CO_2 needs separating from the rest of the gas so you can put pure CO2 in the tanks. This is an expensive process.

A further benefit of turning LNG into power in a fuel cell, compared to direct combustion, is that it has higher efficiency - 60 per cent for a fuel cell, compared to 40-50 per cent for a maritime gas engine.

The project participants hope that with this efficiency 'surplus' it may be possible to achieve the same full lifecycle efficiency as with conventional LNG combustion, with the additional benefit that you have the CO_2 liquefied and put into a tank, ready for discharge at a reception facility.

The project aims to demonstrate how LNG fuel can be used in a zero-emission scenario, making it viable in a net zero era, and finally putting to bed the label "transition fuel".

The vessel would need to be fitted with an LNG tank, a liquid CO2 tank, a solid oxide fuel cell, and a CO2 cooling / separation system.

The volume of a tonne of LNG is about 2.1m3. The resulting liquid CO2 will fill 2.2 to 2.3m3. So, the size of the LNG and CO_2 tanks required is similar.

Members of the research project include ship design and technology company Hav Group, coastal cruise operator Havila Voyages, natural gas company Molgas Energy, and research company SINTEF. It has NOK 5m ($480k) funding from the Norwegian Research Council. Hav group is the project owner and leader.

It is a "desktop" study for now. The project team aim to design the full "power train" including fuel cells, CO2 liquefaction and storage. They aim to confirm the energy efficiency and emission which can be achieved, in real vessel operating conditions,

with a digital simulation based on a system installed on a Havila Voyages cruise ship.

There is a goal to test the solution onboard a vessel in 2030. If the project is successful, Hav is looking at making it a commercial offering in around 2030, as part of its portfolio of low and zero-emission solutions to the maritime sector.

More about the process

Fuel cells are like batteries; a chemical process happens within them to generate electricity (power). So, the gas is not being combusted but brought together with oxygen to make CO2, water and electricity.

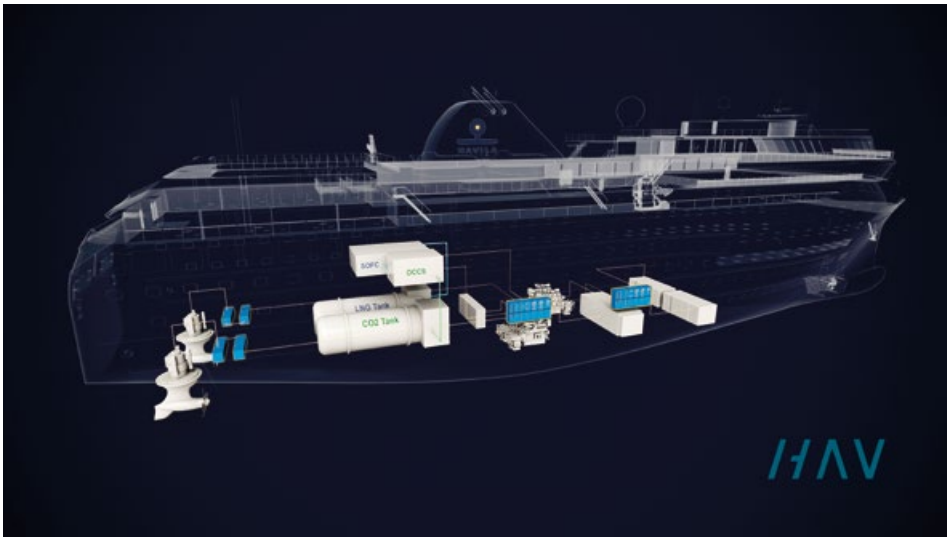
With a "solid oxide" fuel cell (SOFC) the electrolyte (the material which the charged chemical ions pass through) is made from solid oxide or ceramic.

The CO2 and water mixture coming out of the fuel cell can be separated simply by cooling it down, because CO2 and water will liquefy at different temperatures and pressures.

A solid oxide fuel cell operates at between 600- and 1000-degrees C. the CO2 leaving the fuel cell needs to be cooled and compressed to a state where it become liquid, for example 15 bar and minus 30 degrees C.

The gas does not require any energy input to cool it to the ambient temperature (this can be done with seawater cooling). Some of this cooling can be done with a heat exchanger to the incoming gas, so it is used to heat the incoming gas to the fuel cell's temperature.

But it will need further power to run a refrigeration unit and compressor to reach the liquid state.



A possible equipment layout on a Havila cruise ship, with LNG and CO2 tanks, SOFC (solid oxide fuel cell), OCCS (onboard carbon capture / CO2 cooling system), vessel driven by electric motors, and batteries

Cooling calculations

The company has not yet done detailed plans and calculations for the cooling. But it is possible to calculate the theoretical minimum power requirement for the cooling based in the change of energy state (chemical and thermomechanical energy) from the inlet flow to the outlet flow of the capture and liquefaction unit.

If we start with off gas from the fuel cell is at around ambient temperature (15°C) and pressure (1.013 bar), with 60-70 mol% CO2 feed concentration and seek to liquefy 95 per cent of the CO2 to 7 bar, we will need 68-72 kWh/ton CO2.

Meanwhile 1 tonne of LNG in a SOFC fuel cell generates roughly 2.75 tonnes of CO2 and 8200 kWh electricity at 60% efficiency. So, the cooling power requirement for this 2.75 kg CO2 at [68 – 72] kWh/tonne CO2 is between 187 and 198 kWh.

The actual efficiency penalty will be inversely proportional to the thermodynamic efficiency of the CO2 capture and liquefaction system.

But the minimum theoretical power penalty for CO2 separation and liquefaction is about 1.5 per cent of the LNG energy content, and so much less than the difference between the efficiency of conventional gas combustion (say 50 per cent) and power generation in a fuel cell (say 60 per cent).

It is planned that the overall tank to wake efficiency should be 44 to 54 per cent, including onboard carbon capture.

1 tonne of LNG contains 13.6 MWH of energy; of this, 8.2 MWH will be available as electrical power, which creates 6.0 to 7.3 MWH propulsion power.

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DNV's evaluation of energy efficiency technologies

Confused about which energy efficiency technology to install on your ship? So is most of the industry. To try to help, DNV evaluated over 40 technologies, including looking at their costs and suitability

Propulsion and hull energy saving technologies typically make a return in a short amount of time. Operational technologies like speed optimisation typically require small investments. Many machinery efficiency measures like waste heat recovery are quite mature.

Wind assisted propulsion systems (WAPS) offer potentially large benefits but has quite high capex and are not yet proven. It may be better to seek to make a vessel ready for WAPS but not to install it just yet.

When planning your energy saving technologies you need to avoid having systems with benefits which clash, such as adding air lubrication whilst also trying to minimise draw on your auxiliary engine.

DNV has published a study, evaluating over 40 energy efficiency measures and technologies for ships, including looking at suitability for different ship types, sizes and ages. It includes advice like the above.

It is available for free download from the DNV website – look for "Energy-Efficiency Measures and Technologies - Key solutions and strategies for Maritime's decarbonization journey." Results were also presented in a webinar on March 19.

One of the biggest barriers hindering investment is that people do not trust many of the savings figures they are given by vendors, said Jason Stefanatos, Global Decarbonization Director with DNV.

It is clear they cannot all be true, when multiple single technologies claim to save 10-20 per cent, suggesting you could eliminate all fuel consumption with a few different technologies.

DNV seeks to provide objective advice. For each of the 40 technologies, it looked how much each technology will help you comply with various regulations, the capex, expected efficiency gain, opex gain, implementation time, and how it should be retrofitted (while the ship is in operation, or does it need a dry dock). DNV also assessed the maturity of the technology and the level of regulatory acceptance.

It shows the suitability of the technology for tankers of different sizes (and also bulk carriers, gas carriers, car carriers, cruise vessels and container ships); the suitability for vessels of different ages; the applicability for newbuilding or retrofit.

For your choice of new fuels, there is still a great deal of uncertainty, particularly about availability and pricing. Mr Stefanatos recommends choosing flexible pathways as far as you can. "Betting on one horse today may lead to unwanted future aspects."

DNV assesses that the global shipping fleet together could improve fuel efficiency by 16 per cent, equal to the total emissions of 2,500 of the largest ships or 55,000 of the smallest ships.

For example, a capsize bulk carrier on a voyage from Brazil to Rotterdam could reduce fuel consumption for the voyage from 600 tonnes to 480 tonnes over the voyage with energy saving methods, reducing fuel consumption from $300k to $240k.

If it was using more expensive green methanol, energy saving measures could drive a fuel cost reduction of $300k for the voyage, plus saving on FuelEU Maritime and ETS costs.

Audience surveys

The webinar audience was asked which energy efficiency measures are most relevant for your fleet to invest in.

38 per cent said propulsion and hull, 28 per cent said operational methods, 17 per cent said machinery, 9 per cent said energy harvesting, and 6 per cent said energy consumers.

The webinar audience was also asked what their business incentive is for investing in energy efficiency. 41 per cent said for cost savings (including under FuelEU Maritime), 26 per cent said for regulatory compliance (CII / MRV), 8 per cent because of feeling a need to do "something," 7 per cent said it was expected or requested from charterers, and 16 per cent said they didn't know yet.

Different measures

DNV sees energy efficiency measures in 5 categories: propulsion and hull, operational technologies, machinery, improving energy consumers, and energy harvesting (wind and solar).

Propulsion and hull measures include air lubrication, hull fins, stern enhancement, and measures with propellers, rudders, and ducts. These measures are often "fairly new technology", and typically need a short amount of time to make a return on the investment, Mr Stefanatos said.

The most popular measures are propeller retrofits, low friction coatings and propeller flow improvements.

Many container ships are doing propeller retrofits and seeing big savings on overall consumption, he said. Propeller flow improvements are "usually quite fast to install, some do not require dry dock. It is a very common practise in newbuild," he said.

There has been a boom in low friction coatings over the past years, and it is accepted under EEXI.

Hull cleaning is "becoming quite standard for many shipowners."

Operational technologies, including autopilots, optimising bow thrusters, trim optimisation, speed optimisation and weather routing, can be "low hanging fruit," typically requiring quite low investments, he said.

But the gains are "usually moderate".

Just in time arrival has good benefits but "requires co-operation of many stakeholders."

Machinery related measures include waste heat recovery, using batteries, derating of engines, managing load on auxiliary engines, using shore power and variable speed.

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The three most popular machinery measures are the shaft generator, auxiliary engine economizer, and waste heat recovery.

Many of these are "quite mature," he said. "We see old technologies that become relevant again because of changes in economic conditions."

"There is high regulatory acceptance, gains can be low to medium."

The biggest benefit of the shaft generator is that you don't need to use auxiliary engines when sailing.

Waste heat recovery is mainly used on new buildings.

Energy harvesting (wind and solar) can be considered "more exotic technology," he said. These are "quite novel and yet to be proven." The benefits are connected to the weather which the vessel will experience. The capex is "quite high for now".

FuelEU Maritime gives a reward to wind propulsion, and "most probably" IMO regulations will in future.

Combining technologies

DNV also looked at technologies which do and don't make sense to combine.

If you are doing energy harvesting (such as wind power), you will use the engine less, so it may not make sense to also invest in technologies to get more energy from the engine, such as waste heat recovery.

Air lubrication requires more power and so may be best used together with a shaft generator, rather than an auxiliary engine, which creates additional emissions generating the power.

Also, if you reduce the ship's draft to reduce fuel consumption, that may affect the geometry of the hull and make air lubrication less effective.

Air lubrication creates bubbles, which may reduce the impact of having a high-performance coating.

If you are using an exhaust gas boiler on an auxiliary engine (using heat from the exhaust to generate steam or hot water), but also using a shaft generator, the investments are competing' because the shaft generator will mean less use of the auxiliary.

Deeper dive

Mr Stefanatos looked more closely at some technologies – energy efficient lighting, variable frequency drives, WAPS, air lubrication, shaft generators and shore power.

An energy efficient lighting system can be "quite easy to retrofit," but may have the biggest impact on vessels with a great deal of lighting such as cruise ships and car carriers.

Variable frequency drives, allowing the power sent to devices to be adjusted (rather than just turned on or off), is good for engine room fans, large compressors, cooling water pumps. It is used less commonly on steering gear pumps and ballast pumps.

"Typically, it makes quite a lot of sense," he said. "It would not be an exaggeration to say it is standard in new buildings. It is quite easy to retrofit. It can significantly help reduce consumption and emissions."

Wind assisted propulsion systems (WAPS) have been installed or are being installed on over 100 vessels, with 48 per cent rotor sails, 31 per cent suction sails and 19 per cent wing sails. You can receive financial incentives under EEDI, EEXI, CII and FuelEU Martime even if they are not used. The vessel needs to be sure it sails in waters with favourable weather conditions.

Installation can be "quite costly", but efficiency gains can be high. To see the true efficiency gain you need to look at the savings over a whole year, to take seasonal weather changes into account.

It does not require much spending to make a vessel "WAPS ready" – so you may want to do this and then install the technology later when it makes sense, he said.

The benefit of air lubrication systems is linked to the geometry of the hull. "We have seen vessels that make no sense, and vessels which make sense to install it," he said. "It needs to be studied thoroughly."

Shaft generators are "considered almost standard on new buildings," he said. The cost can be "quite high", but the time to make a return on investment can be "quite low".

Shore power has seen a boost over the past year, through regional requirements, such as in the US and EU. 7 percent of global energy consumption (from ships) is at port, 15 per cent for some cruise vessels.

The challenge is that not all ports have space for the required infrastructure, and it only makes sense environmentally if the power is generated from renewables.

It can be better for vessels which always call at the same ports, such as cruise ships, container ships and car carriers.

Low carbon fuels

The main challenge with low carbon and carbon neutral fuels is their availability and price, he said.

For now, biofuels could be "considered the best decarbonisation solution," with minimal retrofitting required, maybe none. Biofuels are already the most popular solution for FuelEU Maritime compliance.

But "there will be challenges with availability and price," he said. "Please make sure you do not just rely on that."

Other technologies relating to fuels are onboard carbon capture and fuel cells. "They are becoming more and more mature," he said. "We expect to see them being used onboard in a few years".

Nuclear power "has definitely a much longer timeline," he said. "We don't expect to see nuclear propelled vessels within this decade." A stepping stone to nuclear powered ships could be floating nuclear power stations close to land.

According to DNV's database, 7.95 per cent of the current shipping fleet is able to run on alternative fuels, including 7.32 per cent on LNG, 0.4 per cent on LPG, 0.22 per cent on methanol, 0.01 per cent on hydrogen and none on ammonia.

For ships on order, 53.07 per cent are able to run on alternative fuels, including 38.03 per cent on LNG, 11.93 per cent on methanol, 2 per cent on LPG, 0.91 per cent on ammonia and 0.21 per cent on hydrogen.

Better data and systems

The industry would benefit from better data about the benefit of various systems, which would require standard ways to gather data and monitor how they perform, Mr Stefanatos said. There are many data acquisition systems being installed on ships. "We need to make sure we all speak the same language."

Savings from real operations may vary. For example, a vessel may reduce fuel consumption by 20 per cent in certain wind conditions but only spend 4 per cent of its time in those conditions. And not every technology will work as expected. "You need to have a proper monitoring process and KPIs," he said.

It would be useful to have standard ways to isolate the specific effect a technology or method is causing, he said.

TO

The case for electric deepwell pumps

Electric deepwell pumps on tankers mean energy savings of 15-20 per cent, more accurate control, avoidance of cavitation, simpler maintenance and quieter operation, says manufacturer MarFlex

By Jan-Douwe Breugelmans, Business and Operations Specialist at MarFlex

For deepwell pump systems, where a pumphead at the base of a tank is powered by a motor above, the key choice has historically been a simple one: hydraulic or electric drive.

Hydraulic pumps rely on a continuous flow of high-pressure oil through a network of valves, piping and controllers, requiring a large, dedicated power unit to run the pumps.

Electric systems, by contrast, draw energy only when the pump requires it. Motor speed is managed via a frequency converter, enabling precise control of flow and pressure, with the added possibility of reusing energy fed into the system.

In most cases, energy savings of 15-20% are standard, with occasional gains of up to 40%. MarFlex estimates that operators typically see a return on investment within 1.5 to 2 years, depending on operating profile.

So electric-driven cargo pumps combined with a frequency converter offer one of the most economically and environmentally sustainable choices, both in terms of CAPEX and OPEX.

In a 2024 report, classification society DNV formally recommended the use of electric-driven cargo pumps with frequency drives and integrated control systems as part of its strategy for reducing maritime fuel use and emissions.

Electric-driven solutions also provide important operational advantages through accurate system control and monitoring, something not possible with hydraulic controllers.

More precise control helps avoid cavitation - the formation of air bubbles in the liquid caused by rapid pressure changes. Cavitation can damage pump components, reduce flow efficiency, and increase the risk of breakdowns.

Other benefits are simplified maintenance, and quieter operation.

Electric-driven pumps also eliminate the risks associated with pressurised hydraulic oil, from environmental spills to cargo contamination and crew safety concerns.

Maintenance is less complex, with no need for routine pressure checks, and many components are easy to service or replace.

MarFlex has supplied over 18,000 electric deepwell pump systems to more than 1,700 vessels, ranging from inland tankers to seagoing ships. Installations span shipbuilding markets across China, Turkey, Korea, Japan, South America and Europe.

A recent example includes a Rotterdam-based inland vessel built by Asto Shipyard and operated by Vario Shipping, now equipped with Smart Pumping Technology.

The MarFlex electric deepwell pump

Regulatory

From a regulatory perspective, electric pumps can help improve fuel efficiency during port operations, particularly when integrated with shore power.

While their impact on CII depends on reporting methodology, electric-driven systems can support emissions reductions under EU ETS and may help limit exposure to FuelEU Maritime penalties.

Elecric pumps also supports compliance with local port noise restrictions with systems designed to run at 62-73 dB and produce less low-frequency noise, which is known to affect crew wellbeing.

Automation

An increasing number of installations now include our Smart Pumping Technology which allows operators to combine their own expertise with intelligent pumping control.

The system automatically reduces energy consumption by following operator instructions in the most efficient way, enhancing discharge speed beyond what is possible with manual control, and continuously protects the system.

This improves operational efficiency, extends equipment lifespan, minimises downtime, and simplifies shoreside support. It also enhances flexibility across multiple cargo types - increasingly important for bunker and chemical tankers handling multiple grades.

How methane slip level affects emissions costs

When using LNG fuel in Europe, the methane slip level will affect costs under EU ETS and Fuel EU Maritime. Wärtsilä modelled what the costs could be at different levels of slip

by Figosta Zhou, General Manager, Decarbonisation & Co-Creation for Power Supply, Wärtsilä Marine.

Methane that is not fully combusted forms part of the exhaust emissions from all LNG engine technologies as "methane slip".

It is included in both FuelEU Maritime and EU ETS via "slip factors."

By considering methane slip at several levels – including the default factor used for four-stroke dual-fuel engines and a level that represents Wärtsila's latest engines , the real cost impact of design improvements can be identified.

The impact of methane slip is clear when looking at costs under FuelEU Maritime. It requires a stepped reductions in greenhouse gas intensity.

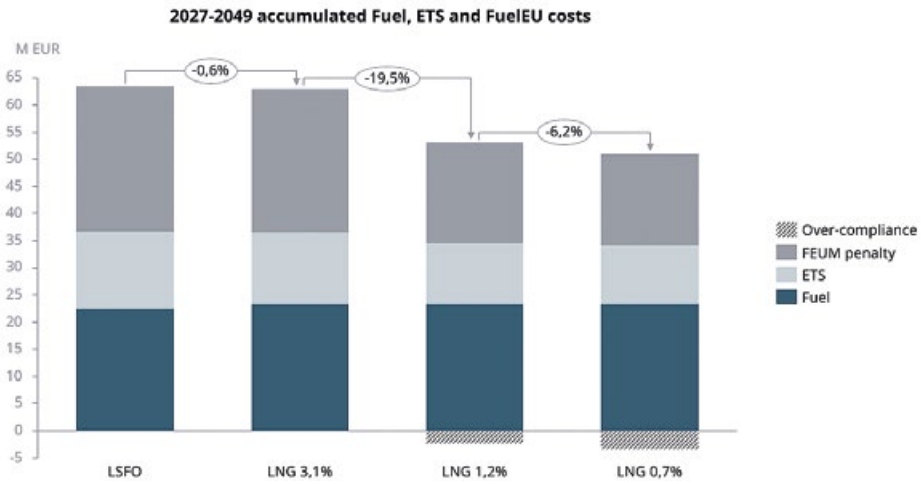
Operators with engines with higher methane slip will be exposed to FuelEU penalties earlier.

For example, by 2034 these penalties will be for engines with slip of 1.2 percent or lower.

Over-compliance is particularly important for FuelEU as it allows operators to use their surplus energy intensity to offset penalties incurred on other vessels in their fleet or pool.

The difference in costs related to methane slip levels is therefore more pronounced in the early years of the regime.

By the mid-2040s, when greenhouse gas intensity reduction requirements are higher, the cost difference of methane slip is less significant.



Comparing your total costs between 2027 and 2047 if using low sulphur fuel oil, LNG with 3.1% methane slip, LNG with 1.2% slip and LNG with 0.7% slip, based on a 15,000 dwt chemical tanker

While costs under EU ETS are lower than for FuelEU across the timeframe, methane slip plays a larger role in those costs. This is because EU ETS exposure is based on tank-to-wake emissions only.

The notable cost gap between the default 3.1 percent slip factor and the lower slip factors will remain.

Between 2027 and 2039, the difference in total cost overall between 3.1 percent slip and 1.2 percent slip is €7.3 million. Between 2040 and 2049, it is €3.8 million.

Although in reality the impact of methane slip improvements will vary depending on the engine and how it is operated, we can observe from the tanker case that every 0.1 percent improvement in methane slip will save operators around €19 for each tonne of LNG consumed.

Wärtsilä's latest advance, NextDF, can be applied to our Wärtsilä 25DF and 31DF engines, reducing methane emissions to less than two per cent of fuel use across all load points, achieving as low as 1.1 per cent in a wide load range.

TO

Drones for tank inspection

The cost of a drone ultrasonic thickness inspection of tanks of a mid-sized vessel can be just 13 per cent as much as with scaffolding, says C-Bird – and can provide more benefit

Specialist ship service provider C-Bird is using drones to do surveys of the interior of tankers, including ballast and cargo tanks, for ultrasonic thickness measurements and the close-up survey required under International Association of Class Societies (IACS) Common Structural Rules (CSR).

A traditional UT inspection for a mid-sized ship can cost $350,000 whereas using a drone can cut this to $45,000 or less, the company says.

It estimates the total savings to a shipowner from not requiring scaffolding, not requiring such big work crews, and speeding up the inspection, could be as much as $1 million.

Drones can be used for all kinds of tankers, and also for cranes, pipework and hull inspections.

The drone pilot does not need to enter the tank, but can instead be guided by a video feed from a camera on the drone, supported by strong lighting, while the software creates a 3D model of the tank.

The equipment

C-Bird uses the "Elios 3" drone from

manufacturer Flyability.

It has a protective cage that allows it to withstand collisions.

It has a camera and laser scanning (LIDAR) system, which records data continuously during flight. This data can be used to build a 3D model of its surroundings that can help pilots navigate monotonous environments like ballast tanks.

The drone also has a 16,000-lumen lighting rig, lighting whatever is in front of the camera.

The drone can gather data in spaces as small as 50x50 cm (20 inches). It can move around obstacles and fit into tight spaces. It can operate in GPS denied areas.

The drone is designed to carry multiple different payloads.

It can be fitted with an ultrasonic testing (UT) probe. It can measure up to 40 UT spots per flight. The probe needs to come in contact with the steel surface.

This ultrasonic testing system was developed together with UT specialist Cygnus Instruments, which has many years of experience with UT testing in the maritime industry.

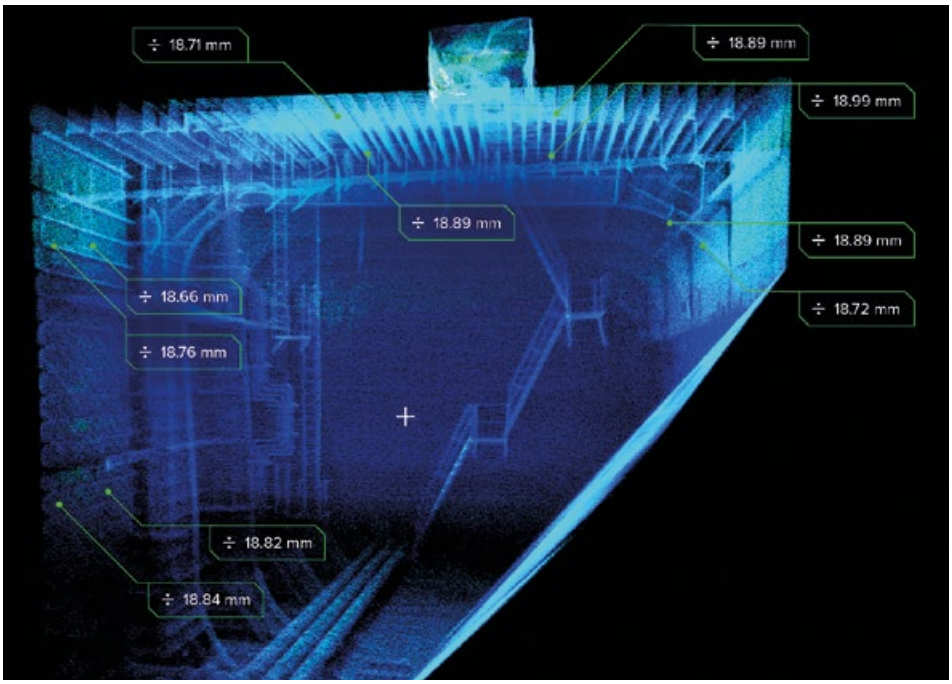
The probe is mounted on an articulated arm which can be adjusted to different positions on the drone to suit the measurement area. There is a laser pointer to guide the pilot. The pilot can adjust the scan parameters.

This UT system can measure thickness to within 0.07mm, within the industry standard tolerance of under 0.1mm for steel thickness of 0.8 to 250mm.

Working with the data

While it is flying, the Elios 3 gathers data which is put together to make a 3D model.

Ultrasonic thickness measurements are also shown on the 3D model.



A 3D model of the tank, with steel thickness measurements, all data gathered by drone. Image Flyability

The pilot can make marks on the digital model, for example to note a point of interest. This can be passed onto an inspector to decide if further measurements of that point are needed.

Inspectors can also review coverage of previous missions so they can see if anything has changed.

The pilot can use the model and record of the flight path to check they have inspected an entire area. This is useful because many parts of a tank can look very similar.

Alternative methods

Ship inspections are normally done with a vessel at dry dock, using scaffolding, ropes, mobile elevated work platforms, rafts or crawlers.

It can take crews of over 20 people to erect scaffolding to inspect large hulls or cargo tanks, says Flyability.

It can take 1 month and cost $500,000 to scaffold an entire 300-meter vessel. Then there are risks from the work being done at height. There are further risks that scaffolding material can get left behind in the tank and later sucked into tank machinery such as pumps.

Doing ultrasonic thickness measurements using ropes requires highly trained inspectors. It is costly and slow, Flyability says. There can be gaps in data collection, and risks from working at height.

Mobile elevated work platforms (cherry pickers) provide quick access, but can only be used in outdoor open spaces. They are expensive and may not be able to reach all areas.

Surveys by rafts are “one of the most hazardous methods”, filling structures with water and using a small inflatable boat. There are risks of drowning and suffocation, and there can be expensive clean-up costs or pollution if the water is polluted by residue in the tank.

Automated crawling devices, which stick to the tank walls using magnets, can work remotely and eliminate the need to have people working at hight. But they cannot move past beams or stiffeners.

Flyability drone with a lighting system and protective cage. Image Flyability

Ballast water news

Upcoming concentrated inspection campaign – IMO review of BWM convention – orders for Alfa Laval – Optimarin new VP

The Paris and Tokyo MoU's of port state control agreed back in 2021 that there would be a "Concentrated Inspection Campaign" (CIC) on ballast water management systems, running from Sept 1 to Nov 30, 2025.

An additional checklist will be used during routine PSC inspections.

The Paris MOU has not revealed any detailed information about the campaign, but says "Concentrated inspection campaigns focus on specific areas where a higher risk of non-compliance could exist."

"This could be evidenced by the number of deficiencies encountered, accidents or where new convention requirements have recently entered into force."

MEPC 83

At IMO's MEPC 83 meeting in April 2025, it continued the ongoing review of the Ballast Water Management (BWM) Convention, including stocktaking of the progress made and consideration of the way forward.

The Committee re-established the Correspondence Group on Review of the BWM Convention to finalize draft amendments to mandatory provisions of the Convention, for submission to MEPC 84 for approval, with a view to adoption by MEPC 85.

Tonje Olafsen, Optimarin

Alfa Laval orders

Alfa Laval reported that its new "PureBallast 3 Ultra" ballast water management system has secured orders from "leading shipyards in China, South Korea, and Japan, as well as shipyards in other parts of the world", it said, without providing further details.

The system's "compact design, reduced footprint, and optimized system integration have been widely appreciated by shipyards, particularly for tanker vessels where space is critical," the company said.

It has "Cleaning-in-Place" and an ultraviolet reactor module, which minimises piping requirements, reducing installation costs and complexity for shipyards.

For shipowners, the system "ensures superior performance in all water conditions while maintaining low power consumption, making BWMS compliance more manageable."

The new system offers enhanced performance, greater energy efficiency, and simplified installation, Alfa Laval says.

Alfa Laval is keen to demonstrate its commitment to the ballast water management system (BWMS) market, "While other market players may be moving to other sectors."

"With the increasing focus on BWMS compliance, especially with the upcoming concentrated inspection campaign (CIC) in September 2025, vessel operators need a strong partner who supports them throughout the vessel's lifetime."

The system was launched in May 2024, and first deliveries will begin in Q3 of 2025. It is produced in Qingdao, China.

Optimarin new VP sales and project

BWTS provider Optimarin of Norway has appointed Tonje Olafsen as VP Sales and Project.

She is a former officer with the Royal Norwegian Navy, with a 15-year career where she served on frigates and coastguard vessels, and worked on shore, handling weaponry, working as helipad crew and launch craft operator.

She was also formerly operations manager at Optimarin.

TO

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