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BUNKERSPOT

INSIDE:

SHIP.ENERGY SURVEY 2024

EBDNS

ELECTROFUELS



Talking shop

2023 was a big year in terms of commitment on maritime decarbonisation, with the adoption of the IMO's revised GHG reduction strategy by the MEPC, and 2024 seems set to be the year when more ships running on alternative fuels start really filling up the shipyards' order books and even hit the water. So we have once again invited a range of experts to give their views on the state of play. And we have also given this year's survey the 'ship.energy' branding for the first time – to reflect the fact that the fleets of the future will be using a much wider range of fuels, propulsion technologies and energy sources

The ongoing saga of the shipping world's journey to net zero emissions was a Tale of Two Cities in 2023: London; and, rather cast against type, Dubai.

At the start of July, the UK-based headquarters of the International Maritime Organization (IMO) hosted the 80th session of the Marine Environmental Protection Committee (MEPC 80), which adopted the much-anticipated revised strategy on the reduction of GHG emissions from ships. Hailed by the outgoing IMO Secretary-General Kitack Lim as a 'monumental development', the strategy has set a target of reaching net-zero GHG emissions 'by around, i.e. close to 2050'. In order to gauge the rate of progress, there are also two indicative checkpoints: reducing GHG emissions 'by at least 20%, striving for 30%, by 2030'; and 'by at least 70%, striving for 80%, by 2040'.

In December, the focus shifted to Dubai where the 28th United Nations Climate Change Conference COP28 produced an international agreement to 'transition away' from fossil fuels. This was also seen as a landmark moment – but it was not the unequivocal 'phase-out' of fossil fuels that many had called for (and which OPEC was determined to avoid) and it does seem to have left a good deal of wiggle room. Indeed, Abdulbaqi Alsalaith, energy adviser to the Iraq Ministry of

Oil, summed up the OPEC position neatly when he said: 'We agree to phase out emissions, phase down emissions, not the fuel.'

Shipping's energy transition is just a part of the picture at the COP conferences – but it is becoming an increasingly important part. The Dubai programme included a flagship conference organised by the International Chamber of Shipping (ICS) as well as a host of side events exploring maritime decarbonisation from all sorts of commercial, technical and political angles. Furthermore, quite a few maritime-related initiatives were unveiled at COP28, including a partnership strategy between the Ports of Singapore, Los Angeles and Long Beach for a green and digital shipping corridor (GDSC) across the Pacific Ocean.

COP28 did not receive quite as much global media attention as previous climate conferences because it was sharing the spotlight with other events taking place in the Middle East. Trying to explain, much less resolve, the Israel-Palestine conflict goes far beyond the remit of *Bunkerspot*, but we will be asking our Annual Survey respondents to consider its possible impact on shipping, bunkering and energy security in the region.

Turning from global warming and wars to the specifics of bunkering, 2023 brought progress on a number of fronts. MEPC

80 was the headline act, but we have also seen more industry players teaming up to develop the supply sources, delivery infrastructure and bunkering protocols needed for methanol and ammonia. There's not much up and running right now, but at least we are closer to laying the foundations.

Meanwhile, the roll-out of methanol-fuelled ships seems to be gathering some real momentum. Maersk, for example, has around two dozen dual-fuel methanol container ships on order and in February, soon after this issue of *Bunkerspot* goes to press, it is set to bring its first methanol-fuelled 16,000 TEU boxship into service on the AE7 string connecting Asia and Europe.

We are also seeing biofuels gaining more traction in the marine market – although (our survey responses will reveal) this is not a development welcomed by everyone.

There is more unanimity over the growing use of mass flow meters (MFMs) to provide transparency in bunkering. Singapore has led the way here, having introduced the mandatory use of MFMs in 2017 and now Rotterdam and Antwerp-Bruges will make them mandatory in 2026. Finally, our ship.energy survey for 2024 concludes with a discussion on how broader political events could support – or impede – the shipping sector and its energy transition.

contributors

Our pool of contributors for the ship.energy annual survey represent a broad cross section of the industry. Some participants answered the survey questions but chose not to make their comments public and we have, of course respected their wishes.

We thank everyone for their contributions – and we are especially grateful to the following:



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Milestone meetings?

The first question on our ship.energy survey 2024 was a big one: did MEPC 80 and COP28 represent significant progress for shipping's energy transition?

The adoption of the revised IMO strategy on the reduction of GHG emissions from ships was the main take-away from 80th meeting of the Marine Environmental Protection Committee (MEPC 80) in July, while the UN Climate Change Conference COP28 in Dubai produced an international agreement on the need to transition away from fossil fuels.

Do you believe that, taken together, MEPC 80 and COP28 represented significant progress for maritime decarbonisation and the broader energy transition, and do you expect more progress at MEPC 81 in March and COP29 in November in Azerbaijan?

The International Bunker Industry Association's (IBIA) Executive Director **Alexander Prokopakis** was in no doubt that: 'The 2023 IMO GHG Strategy was the most significant event for 2023 regarding efforts addressing GHG emissions from international shipping. There is a long way to go but now there are tangible goals attached.'

Edmund Hughes, who has a ring-side seat at the Albert Embankment HQ as IBIA Representative to the IMO and previously served as the Head of Air Pollution and Energy Efficiency at the IMO, was in full agreement with his colleague that the 2023 IMO GHG Strategy was the most significant event of the year for addressing shipping's emissions, but he also pointed out that other initiatives are also underway and picked out the Clean Energy Maritime (CEM) Hubs Initiative partnership between the International Association of Ports and Harbors (IAPH), the Clean Energy Ministerial (CEM) and the International Chamber of Shipping (ICS) as 'an example of collaborative efforts needed to support the 'net-zero' goal "by or around" 2050 that IMO has agreed'.

Focusing on what was actually agreed at MEPC 80, Hughes said that: 'For bunkering the following paragraph from the Strategy is likely to have the most profound effect over the coming decades:



“3.2. The levels of ambition and indicative checkpoints should take into account the well-to-wake GHG emissions of marine fuels as addressed in the *Guidelines on Life cycle GHG intensity of marine fuels (LCA guidelines)* developed by the Organization [Resolution MEPC.376(80)] with the overall objective of reducing GHG emissions within the boundaries of the energy system of international shipping and preventing a shift of emissions to other sectors.”

‘This goal, as it is built into the regulatory measures currently under discussion at IMO and agreed this decade, has significant implications for the whole marine fuel supply chain.’

Unni Einemo, who was as IBIA representative to IMO and now serves as Director of

Communications at CORE POWER, explained how MEPC 80 also marked a moment of personal transition for her: ‘The significance of the IMO’s revised GHG strategy adopted at MEPC 80 is enormous. Many used to think the 50% overall cut in GHG emissions by 2050 was impossibly ambitious. It has really sharpened the focus though, and given the clear signal the market needs to get on with an energy transition that makes IMO 2020 look like a walk in the park.’

‘Fossil fuels have to be phased out, and other fuels for shipping must not cause an increase in lifecycle emissions – another critical decision made at MEPC 80. It means the energy used to produce alternative fuels must be “green”, i.e. come from renewables, or nuclear energy.’

‘While MEPC 80 was underway, I was getting ready to change roles from being the Director and IMO Representative for IBIA to work for CORE POWER, which is working on bringing advanced nuclear-powered ships to the market. This was my personal transition from fossil to the future, and it made perfect sense to me because nuclear energy is the only true zero emission solution for shipping. It will also help meet demand for the massive amounts of energy required to produce alternative fuels. More and more people have come to realise this.’

‘Even COP28 made the historical decision to finally address the elephant in the room and agreed to “transition away” from fossil fuels. The agreement adopted at COP28 also, for the first time, explicitly recognised nuclear energy as one of the tools to achieve “deep, rapid and sustained reductions in greenhouse gas emissions”. Basically, COP28 reflected growing global acceptance for the fact that we need nuclear energy to combat climate change.’

The supply side of the industry were clearly watching events at the IMO HQ closely. Baseblue’s **Dyonisis Diamantopoulos** told us that: ‘It is clear that there is a strong will from the side of the United Nations overall and more specifically from IMO for our industry to furtherly advance the “Green Agenda” with the ultimate goal of the protection of the environment.’

‘The latest MEPC showed that that effort is being intensified, especially in matters related to greenhouse gas emissions from the maritime industry, as we saw some new milestones and targets arising such as the 20%, 70% and 100% reduction of GHG emissions by 2030, 2040 and 2050 respectively. This outcome has shown that besides Europe and European regulations more and other ambitious GHG emission reduction agendas are in play. We will be monitoring the developments and will be excited to see how the IMO will regulate further in the upcoming years and next MEPCs.’

Monjasa’s **Almanda Terese Molter** applauded last year’s efforts, but emphasised there is still a long road ahead: ‘The outcomes of both MEPC 80 and COP28 represented significant progress for maritime decarbonisation and highlighted the industry’s commitment to transitioning away from the use of fossil fuels. Although the formulation of both leaves wiggle room for interpretations, the revised IMO strategy, for instance, doubtless sets quite ambitious targets for the industry, indicating which direction the industry is moving. Expectations are thus high, as we approach MEPC 81 in March. Much work is needed if member states are to agree on both an economic and technical mid-term measure in 2025 at MEPC 83.’

Nautical Supply International’s **Karl Shrowder** cautioned that if we are to see significant changes on maritime decarbonisation ‘not only do we need a roadmap but enforcement on non-compliers similar to what the EU have with regards to Emissions Trading System (ETS) compliance’.

‘Once we have mandatory measures similar to IMO 2020 sulphur cap reduction but with regards to the holistic GHG reductions of a vessel(s),’ said Shrowder, ‘only then will we see a real change in the CO₂e emission reductions.’

Houlder’s **Sean McLaughlin** judged that: ‘MEPC 80 and the IMO’s revised GHG strategy can be seen as a step in the right direction – but implementation and achieving the new emissions targets is the real challenge. To rise to this challenge, the shipping industry needs a well-defined view on green solutions. It’s essential that the shortcomings in existing measures such as the Carbon Intensity Indicator (CII) which drive so many unintended consequences are addressed quickly. Regulators are in new territory and significant new measures such as this need to evolve in partnership, with neither side of the debate becoming entrenched. We also need to see progress on the alternative fuel pathways, and the industry needs a clear understanding of the viability and maturity of various energy efficiency and renewable propulsion (clean) technologies.’

‘COP28 had its ups and downs, but it seems that more of shipping’s private sector were vocal at the conference than ever before. MSC, Maersk, CMA CGM, Hapag-Lloyd and Wallenius Wilhelmsen issued a joint declaration calling for an end date for fossil-only powered newbuilds and urging the IMO to create the regulatory framework required for the green fuel transition. Many charterers also reiterated their net-zero shipping commitments – sending clear demand signals to the shipping industry.’

‘MEPC 81 and COP29 will surely also have



their challenges, but the direction of travel is clear, from both a regulatory and market perspective. Ship owners and operators need to respond with comprehensive sustainability strategies that encompass all the evolving technical, economic and regulatory variables in this rapidly evolving environment.'

PowerCell Group's **Victor Åkerlund** was also pleased with the direction of travel from both the MEPC and COP camps: 'At the end of COP28, the official COP agreement didn't specifically talk about shipping. However, it did emphasise the importance of accelerating the use of clean energy sources like renewables and stressed the need for cleaner technologies in hard-to-abate sectors, which shipping is commonly referred to as. Additionally, the agreement highlighted the importance of producing low-carbon hydrogen. All-in-all, we think this a positive development which in the end should benefit the decarbonisation of the maritime sector.'

'It was also encouraging to see thirty shipping sector leaders at COP28 committing to scaling up zero-emissions fuel, derived from renewables-based hydrogen to nearly 11 million tonnes by 2030.'

'Regarding MEPC 80,' continued Åkerlund, 'it was positive to see IMO adopt a revised strategy to reduce GHG emissions from international shipping.'

'However, we also note that the gap between the net-zero emissions trajectory needed to keep within 1.5°C warming and the actual emissions trajectory is increasing. We strongly support and hope for more climate action from policymakers, as well as business leaders, so let's keep our fingers crossed for even better outcomes at MEPC 81 and COP29!'

DNV's **Eirik Nyhus** was impressed by the unanimity of support from the MEPC for the revised GHG strategy: 'MEPC 80 represented a significant step forward for shipping decarbonisation, both in significantly raising level of ambition, but also in that every member state joined the consensus – this time there were no holdouts. We expect this to be reflected in the work on the new regulations that are to be adopted at MEPC 83 in 2025.'

'MEPC 81 is going to be significant in terms of building a consensus on the overall framework of these regulations. However, neither the GHG intensity standard mechanism nor the economic instrument will be finalised in all details at MEPC 81, so there will be significant technical work necessary prior to their approval at MEPC 82. Given the complexity of the work it would not be surprising to see the necessary work on finalising guidelines slide into 2025.'

Nyhus continued: 'COP28 was less sig-

nificant from a shipping perspective as all UN-related regulatory actions will remain with the IMO. However, it did provide an opportunity for the shipping community to showcase its ambitions as well as its commitment to the IMO GHG strategy and upcoming regulatory efforts. We expect COP29 to be more of the same as far as shipping goes, but hope that progress on voluntary commitments such as e.g. green corridors, made not only at COP28 but also at COP 26, will be material.'

Steve Jones from the Sustainable Shipping Initiative was another survey respondent who emphasised the importance of the industry pulling together, so we can 'translate ambitious aspirations into tangible actions'.

'The true measure of success,' continued Jones, 'rests on our ability to turn discussions and ambitions into implementation strategies. So, the shift in focus from ambitions to actually hitting targets and meeting goals.'

'MEPC 80 and COP28 have started to demonstrate that shift from ambition to targets. Expectations for further progress at upcoming meetings remain high. Not least because of the willingness, energy, drive and innovation shown by leaders in shipping, such as members of the Sustainable Shipping Initiative.'

'The significance of the IMO's revised GHG strategy adopted at MEPC 80 is enormous. Many used to think the 50% overall cut in GHG emissions by 2050 was impossibly ambitious. It has really sharpened the focus though, and given the clear signal the market needs to get on with an energy transition that makes IMO 2020 look like a walk in the park'

Unni Einemo, CORE POWER

'The key to success is now in fostering a culture that champions proactive measures and meaningful outcomes. Taking the accomplishments of leaders and making sure that the lessons, the technology and the efforts are translated across the entire maritime industry. Maritime decarbonisation rests on the real ability to future fuel vessels, ships which are energy efficient, and which are run by skilled, knowledgeable and experienced people. Yes, we must never forget the seafarers as part of this just transition.'

Idwal's **John Nicholson** called for more details – and funding – to back up the commitment: 'I feel that substantial methods of reducing GHG emissions, penalties and

rewards need to be clearly set out for the shipping industry to follow. More funding and incentives have to be provided for ports to install alternative fuel supplies. Ultimately, the shipping industry will keep using the cheapest fuel options to keep their vessels moving, and will not seek alternatives until forced into it. We have seen a similar response with EEXI compliance with multiple vessels having the equipment installed to reduce their speed and therefore their GHG emissions but opting not to do so until the latest possible compliance date.'

Gavin Allwright of the International Windship Association (IWSA) also focused on the need for delivery: 'The outcome from MEPC 80 was a very impactful one, the strategy agreed was a significant step up from the initial strategy and sets shipping on a far better trajectory. Does the strategy deliver on everything with the level of urgency required? Is it fully aligned with the Paris targets? Of course not, but the message is strong and clear – decarbonisation is locked in, shipping has the means to deliver, and regulatory measures will be increasingly tightened to ensure that this activity is scaled. This in turn gave the shipping industry a very good

story to tell at COP28, and while there were few real additional commitments made there, the narrative clearly aligned with the mood of the gathering, one of movement to action and away from simply pledging action. We saw that message being delivered by the shipping industry and IMO loud and clear with multiple high level side events etc.'

'From a shipping policy perspective,' judged Allwright, '2023 therefore could be viewed as a watershed year, but mainly due to MEPC 80, then showcased at COP28.'

'From a wind propulsion perspective, we would always like to see the highest ambition, targets and pathways being supported and, in that sense, MEPC 80 outcomes reflect a com-

promise, which is natural. We were encouraged to see that the language around zero-or low-emissions fuel provision (5% striving for 10%) was amended to include 'technologies' and 'energy sources' which includes wind propulsion. The use of indicative checkpoints rather than firm, enforceable goals was concerning but ultimately these are perceived as targets. We need to hit these levels if we are to have any chance of delivering on the more distant 2050 (or thereabouts) goal. 'Frontloading the decarbonisation efforts for 2030 is vital, in fact this is the only one that really matters, thus 20% striving for 30% reduction is weaker than we would like, as 30-50% is achievable if we really pull the stops out and back fleetwide rollouts of energy efficiency measures, voyage optimisation and wind propulsion (retrofit and new build). Taking the 20-30% emissions reduction as a floor rather than a ceiling would serve us well as we face unprecedented climate impacts over the coming decade.'

Nicholas Woo of Birketts said that he has 'never been clear what these meetings actually achieve in the shipping context' – adding that, while he 'supported the fact that greater pressure must be put on the industry to reduce their carbon emissions', he was concerned that 'sometimes the lofty ideals of "net zero for all" are going to be very difficult to achieve'.

'We all know that the shipping industry exists in an extremely complex "biosphere" which in turn affects the global economy,' he continued. 'You do not want inadvertent pressure from the crusading non-shipping side to cause unintended catastrophic consequences to the shipping world.'

Albert Leyson of Drew Marine felt that progress was made last year – and the momentum will continue: 'I believe the ambitious targets set by both conferences represented progress in defining and committing to decarbonisation and imminent energy transition from conventional fossil fuels to alternate sources of energy including increased use of infinite alternate and renewable fuels. Of course, we should anticipate ongoing progress in future gatherings where many of the major challenges identified including the finance and the investment in green transformation projects especially in developing countries can be overcome without delay.'

Diane Gilpin of Smart Green Shipping was not so sure, telling us: 'I lack confidence in MEPC/COP processes to deliver sufficiently ambitious targets to reduce emissions in line with climate science. I am especially disappointed that COP29 displays such a lack of diversity with no women selected for any of the 28 positions on the climate committee. It makes the whole process feel very last-century and uninspiring.'

Allyson Browne – as befits the CEO of the High Ambition Climate Collective (HACC) –

'I lack confidence in MEPC/COP processes to deliver sufficiently ambitious targets to reduce emissions in line with climate science'

Diane Gilpin, Smart Green Shipping

was looking for IMO Member States, governments and shipping companies to raise their game. 'MEPC 80 delivered a significant improvement to the IMO's initial GHG reduction strategy,' she said, 'but it still fell short of aligning the global shipping industry with a 1.5°C decarbonisation trajectory.'

'Now, the IMO must revise its short-term measures (Energy Efficiency Existing Ship Index (EEXI) and the Carbon Intensity Indicator (CII) to be more effective, which it can do by increasing their required emissions reductions, expanding the scope to CO₂e emissions (not just CO₂) and covering well-to-wake emissions under CII. The CII should be revised to include requirements for corrective action plans and consequences for failure to implement corrective actions, like revocation of a ship's environmental certificates.'

'For the new mid-term "basket of measures" being developed, we need an ambitious, 1.5°C-aligned GHG fuel standard (GFS) and a progressive economic element that will jumpstart and sustain a just transition for the global shipping industry. In the interim, countries can follow suit behind the European Union and its ETS and FuelEU Maritime policies and help the industry right the ship on the course to zero emissions.'

'COP28 welcomed progress on green shipping corridors and the US-Norway Green Shipping Challenge, demonstrating the importance of international collaboration in maritime decarbonisation. However, the real test will be the implementation of these strategies and action from all stakeholders, including ports, policymakers and indus-

try participants, to deliver on their commitments. HACC was pleased to see the CEOs of Maersk, CMA CGM, Hapag-Lloyd, MSC and Wallenius Wilhelmsen issue a joint declaration for an end-date for fossil-only powered newbuild vessels, urging the IMO to create the regulatory conditions to accelerate the transition to green fuels. Combined with the right regulatory and economic support mechanisms, commitments like this are critical to jumpstarting this transition to a zero-emission shipping future. Now, we hope to

see these shipping giants put the money on the table that's necessary to get these vessels in the water as quickly as possible.'

Also from among the NGOs taking part in this year's survey, **Antonio Santos** of Pacific Environment stressed that committed individuals – and governments – should continue to force the pace.

'While the 2023 IMO GHG Strategy represents a significant improvement over the previous 2018 strategy and sends a strong signal to the shipping industry that they must reduce their GHG emissions,' said Santos, 'the strategy lacks alignment with the Paris Agreement's 1.5°C temperature-warming limit to avoid the worst impacts of climate change. As the IMO now moves forward in its negotiations to finalise technical and economic measures to meet the levels of ambition agreed to in the strategy, member states and other stakeholders must work together to put in place clear and effective regulations that will transition the industry away from the use of fossil fuels. Short-term measures like the Carbon Intensity Indicator also need to be revised and strengthened.'

'Having said that, adoption of the IMO's revised GHG strategy action does not preclude individual countries from setting their own shipping decarbonisation requirements. In the US, the Biden administration has been a strong supporter of climate action at home and abroad and has provided welcome frameworks for the transition to zero-emission shipping through its Blueprint for Transportation Decarbonization and Ocean Climate Action Plan. However, more needs to be done.'

'Pacific Environment and our allies continue to advocate for domestic action to acceler-



ate shipping decarbonisation, including calling on the Biden administration to issue an Executive Order with specific actions that will unlock opportunities and innovation for decarbonising the maritime sector. And advocating that Congress pass two bills introduced last year that would direct the U.S. EPA to promulgate GHG intensity standards for the fuels used by ships calling on U.S. ports (the *Clean Shipping Act of 2023*) and would provide funding for modernising the U.S. fleet and address pollution in port communities (the *International Maritime Pollution Accountability Act of 2023*). Strong and enforceable interna-

governmental measures through the IMO in tandem with strong national action can put the shipping industry on a 1.5°C-aligned pathway.’

governments during the two weeks, including the US and Norway announcing a new round of over 60 new or updated projects under the Green Shipping Challenge and announcements by several countries pertaining to the completion of strategies and studies to advance the roll-out of green shipping corridors (e.g., Singapore-U.S., the Republic of Korea-U.S., and the United Kingdom-U.S.).’

Opportunity Green’s **Blánaid Sheeran** said: ‘Although the revised 2023 GHG Strategy falls short of a 1.5°C aligned trajectory, it is a serious improvement on the IMO’s previous emissions reduction goals, in particular, the targets of at

least 30% GHG emissions reduction by 2030 and 80% by 2040 (all on a well-to-wake basis).’

which included a goal to have a levy on GHG emissions from the maritime sector agreed at the IMO. Initiatives like this help to bring attention to the role of polluting sectors like shipping in innovative and additional financing for climate action. We’ll be watching this space over the next year and in the lead up to COP29 in Azerbaijan.’

Environmental Defense Fund’s **Panos Spiliotis** and **Sofia Esquivel** felt that the outcome of MEPC 80 was ‘surprising to many’ – and pleasantly so. ‘Even though the ambition agreed in July falls short of delivering the 1.5°C temperature goal of the Paris Agreement,’ they said, ‘it was an important development which shows that even sectors that are dubbed as hard to abate can and should aim to clean up by mid-century. Getting the ambition in place was an important first step, but it is crucial that actions translate that goal in the real world and that they happen in a timely manner – measures introduced in the coming years must match that level of ambition.’

Elissama Menezes of Say No to LNG focused on methane emissions. ‘During the MEPC 80 conference,’ she emphasised, ‘the IMO revised its strategy on greenhouse gas (GHG) emissions to take into account the well-to-wake emissions of marine fuels. This means that LNG’s methane and CO₂ emissions on a well-to-wake basis will be considered part of the new emissions standard. Methane emissions reduction was also mentioned as a possible mid-term measure for further action by the Organization to reduce GHG emissions from ships.’

‘At COP28,’ Menezes continued, ‘global leaders reached a clear understanding and agreement on the impacts of methane emissions on the climate and human health. Methane is no longer being ignored in climate commitments, and tackling its emissions is now widely recognised as a low-hanging fruit in climate action. Fossil fuels were included in a UN climate change text for the first time, and countries were called upon to transition away from them. The final COP28 text also called on countries to reach net zero emissions by 2050.’

However, Menezes believed that: ‘Several loopholes in the final agreement could jeopardise a liveable future on Earth. For instance, there is no clear definition of “transition away from fossil fuels”, and no specific timeframe has been established to phase them out. Furthermore, the final text recognises a role for “transitional fuels”, common industry jargon encompassing LNG.’

‘In summary, the progress of the next MEPC and COP depends on the details of the agreements. The IMO is currently performing a life cycle assessment (LCA) to determine

‘I think that COP28 gave us a good snapshot of what world leaders are thinking about and how tiny a role maritime plays in the conversation. If we want to get things done, we do need to power it from within the sector’

Namrata Nadkarni, Intent Communications

‘The final text of the climate deal called for “transitioning away from fossil fuels in energy systems, in a just, orderly and equitable manner,” falling short of calls from environmental advocates worldwide for a full phase-out,’ Santos said – but on the plus side: ‘On the maritime front, it was great to see several announcements made by

Santos recounted that he was actually ‘on the ground’ in Dubai for COP28, where he was disappointed to see that the conference’s final declaration resulted in a ‘compromise among the countries on the shift away from the use of fossil fuels’.

least 30% GHG emissions reduction by 2030 and 80% by 2040 (all on a well-to-wake basis).’

However – while Santos said that countries should not feel held back by the pace at IMO – Sheeran was concerned that: ‘MEPC 80 demonstrated certain stakeholders’ disinterest in aligning international shipping with the Paris Agreement warming limit of 1.5°C, with several countries pushing for particularly low or non-existent 2030 and 2040 targets during the IMO discussions, as well as failing to prioritise climate justice during the decision-making process, with representatives from some of the most climate vulnerable countries being excluded from elements of the discussions.’

Despite these misgivings, Sheeran believed that: ‘There is potential for significant progress in the coming year. At MEPC 81, countries are set to finalise the basket of measures that must achieve the agreed targets, although they will not be approved until 2025. We need to make sure that stringent measures are agreed to both reduce emissions and further a just and equitable transition, including an ambitious levy on GHG emissions that can provide new and additional financing, separate to any mechanisms under the UNFCCC framework, to help tackle the mitigation and adaptation needs of climate-vulnerable countries.’

Turning to the COPs, Sheeran said that: ‘At COP28 we saw the launch of a new international taxation task force to scale up development, climate and nature action



<https://bit.ly/Ocean-Climate-Action>

GHG emissions from fuel production to the end-use of that fuel by vessel. This process has the potential to hold the shipping sector accountable for its methane footprint and reveal that using LNG as a marine fuel offers no climate benefits from a life-cycle perspective. COP29 has the opportunity to strengthen climate commitments by establishing clear definitions of transition that do not include any fossil fuels or loopholes and by setting a timeframe to achieve zero emissions by 2050.'

From among the consultants taking part in our survey, **Nigel Draffin** drew on many years' of MEPC watching to reassure us that: 'The issue is always the political balancing act but in general it always does move forward.'

For **Adrian Tolson** of 2050 Marine Energy, it was a tale of progress at the IMO in London, and gesture in Dubai. 'I think MEPC 80 was a significant success as it will lead to requirements for international shipping and regulation that will create concrete impacts, but I can't say I feel the same about COP28. I see COP more about grand gesture rather than real progress. I accept that I am a cynic and grand gesture is sometimes required – but, to me, MEPC 80 and IMO are ones making progress in the maritime sector.'

Namrata Nadkarni of Intent Communications will also be looking for IMO to power ahead – with its new Secretary-General **Arsenio Dominguez** at the helm. 'Significant progress is in the eye of the beholder,' she said, 'and while I think there is a lot more that can be done to fast-track maritime decarbonisation, I am aware that I'm at one end of the spectrum in my views (particu-

larly when compared to stakeholders that have invested a lot of money in assets that will face early obsolescence if the sector changes).

'I think that COP28 gave us a good snapshot of what world leaders are thinking about and how tiny a role maritime plays in the conversation. If we want to get things done, we do need to power it from within the sector. I am optimistic about MEPC 81 given that the new IMO Secretary General has spent significant time in his career in the IMO's Marine Environment Division – and also because we are speeding towards predetermined GHG emission reduction targets in 2030, 2040 and 2050.'

'Progress but not significant progress', was the verdict on MEPC 80 and COP28 from Shipping Strategy's **Mark Williams**, who added: 'IMO needs a global alternative to the EU ETS. A cap and trade system could work but a better alternative would be a levy and subsidy system which rewards early adopters of low carbon fuels with cash hand-outs taken from the kitty. COP has clearly been taken over by fossil fuel entryists. It will never achieve much more unless and until it agrees a phase-out date for fossil fuels.'

The First Conference of Parties meeting was held from 28 March to 7 April 1995.

In his opening address to the plenary session, German Chancellor **Helmut Kohl** said: "The industrialised countries have to take responsibility to limit CO₂ emissions permanently beyond the year 2000. That is a vital first step and we should stand by this goal."

'The US delegation conceded that there was little support in the US Congress for such a goal. **Kristy Hamilton**, a Greenpeace delegate, said at the meeting that: "The

OPEC countries have systematically all the way through this process acted to undermine action on climate change. They're still trying to do that at the moment. And we see it as a triangle emerging between the US, oil producing countries and the fossil fuel industry."

'Nothing has changed since. For as long as nation states and corporations are allowed to work in their own self-interest at COP meetings, the system will continue to fail to do the one thing it was set up to do, i.e. reduce global CO₂ emissions so that atmospheric CO₂ concentrations return to their 1990 levels. The system will also fail to meet its Plan B, if you like, of limiting temperature rises to 1.5°C above pre-industrial levels. Since the Rio Summit in 1992, more CO₂ has been emitted than in all preceding human history.'

Kasper Sogaard, who recent established the new consultancy **MakingSense**, worked for many years at the Global Maritime Forum, where he led the development on a number of decarbonisation initiatives, including the Getting to Zero Coalition, Poseidon Principles and All Aboard Alliance. This has given him a particular insight on how complex collaborative agreements can be.

'The MEPC 80 outcome was very significant as it for the first time made the full decarbonisation of the shipping industry by mid-century a shared global ambition and in addition introduced 2030 and 2040 milestones that will require immediate regulatory action to be within reach,' said Sogaard. 'As always however the devil is in the details and here the coming MEPC meetings will be crucial as we need to see governments coalesce around the set of measures that will make shipping decarbonisation commercially viable, while ensuring a just and equitable transition acceptable to developed and developing countries alike.'



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Fueling the future

In this section of the survey, our respondents consider which alternative marine fuels gained or lost ground in 2023 – and the likelihood that they will increase their market share in the coming decades

Biofuels, LNG, methanol, ammonia and hydrogen have all been touted as potential alternative marine fuels. Each has its own commercial and operational strengths and weaknesses, proponents and detractors, and differing levels of readiness.

Which of the alternative fuels do you think 'raised its game' as an alternative to traditional bunker fuel in 2023? And which alternative fuel do you believe may have lost ground in 2023?

Jason Stefanatos of DNV emphasised the momentum that is now building for the transition: 'One could say that 2023 was the year that alternative fuels started becoming mainstream, at least in terms of newbuilding orders and discussions. Never before have we seen 50% of vessel orders placed with dual-fuel capabilities, while even the most exotic fuels are being discussed and considered for orders in the near future.'

'With that in mind it is really tough to pick between the fuels. Although methanol definitely "raised its game" with a high number of NB orders, the use of biofuels could be the most interesting change as we saw vessels of various types using biofuel blends. Many owners and managers looked at the potential supply and cost of biofuels, as this is one of the

simplest ways to comply with the new GHG regulations, albeit at a higher cost and with some uncertainty remaining on availability. Finally, ammonia went from being an exotic, futuristic fuel to being considered for NB orders to be delivered in the next 2-3 years.'

Responding to the second part of our question, **Stefanatos** said: 'LNG would have been the fuel to lose ground, as a result of the impressive price rises. However, over the year and once the price came down to normal levels, LNG started to gain ground again. This makes sense as LNG-as-a-fuel remains a proven solution with many years of experience in the industry both in terms of building and operating LNG-fuelled vessels, while at the same time availability and bunkering infrastructure is reasonably widespread.'

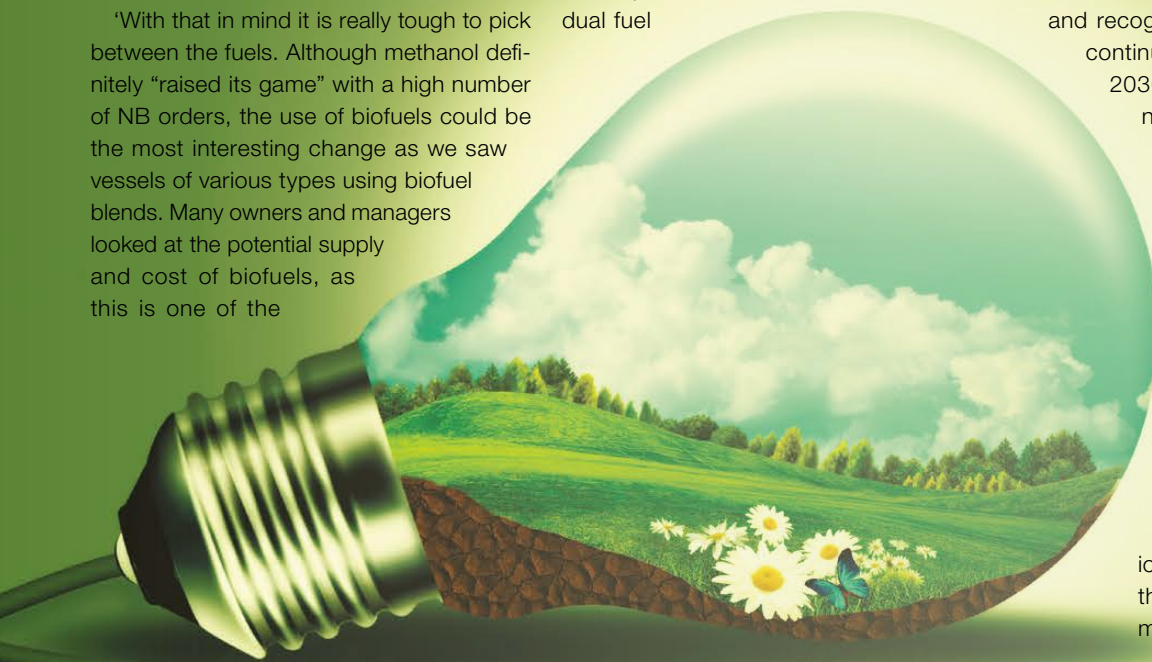
Nick Brown of Bureau Veritas spoke for many when he judged that: '2023 was a big year for orders for methanol-fuelled ships 'With increasing visibility of this future fuel option in dual fuel

engine designs, "methanol ready" is now considerable across the containership and bulk sectors in particular. Near the end of the year, we saw some significant orders for very large ammonia carriers (VLACs) designed to burn ammonia as fuel, with a growing number of "ammonia ready" ships on order. Despite these developments, LNG fuel maintained its position as the primary choice, while biofuels continued to be the main green fuel option currently available. We can expect to see more of the same in 2024 but look forward to more news and developments from engine makers, as well as developments in future fuel supply and progress resulting from collaborative efforts with industry stakeholders through Joint Development Projects (JDPs).'

Monjasa's **Almanda Terese Molter** said that: 'Although LNG still makes up the largest fraction of newbuild orders, the increase in methanol dual fuel vessels show a promising alternative path to traditional bunkers, one that has quickly been picked up and recognised and is only expected to continue increasing as we approach 2030. In contrast, hydrogen still needs a break-through before it can materialize into a promising independent fuel pathway.'

IBIA's **Alexander Prokopakis** gave the most positive response, saying that 'methanol is the clear winner for 2023 as it gathered momentum considering the significant increase of new vessels ordered with methanol as a fuel'. He added: 'No alternative fuel lost ground in 2023 in my opinion. We are starting to see what the future will hold, a multi-fuel mix rather than a single choice'.

His IBIA colleague **Edmund Hughes** took an evolutionary



view: 'All fuels are under consideration but are at various stages of regulatory development/implementation. As such "drop-in" fuels have an initial advantage and certainly can be used to achieve compliance with short-term regulatory requirements e.g., IMO CII and EU ETS. However, after 2030 it is fully expected that to achieve the ambitions set out in the 2023 IMO GHG Strategy there will likely be a need to see greater adoption of "zero" carbon fuels such as ammonia and hydrogen.'

Nigel Draffin adopted a similar approach, judging that methanol made progress in 2023 while 'hydrogen will only become a serious player when we start to see synthetic fuels (2035-2040)'.

Hydrogen did not feature heavily in the responses to this question – perhaps because many felt it was a topic for future discussions.

John Nicholson of Idwal noted that: There seems to have been little news about the development of shore side infrastructure into providing hydrogen fuel or into the ordering of hydrogen- powered vessels in comparison to the other alternatively-fuelled vessels.'

Adrian Tolson of 2050 Marine Energy cast an eye over all the options: 'I really felt methanol established itself as the front runner in the fuel of the future stakes – ease of use and safety worked well. I think Biofuels as the immediate drop in solution to GHG emissions raised its game, but I am not sure how this translates a decade in the future – perhaps it is more questionable whether it will continue to grow in importance.'

'LNG also oddly enough did well. The need to provide infrastructure for existing vessels using LNG presents a great opportunity to build a stronger supply platform globally – also the end solution of bio-LNG provides some solace to the anti-fossil lobby. It also appeared that methane slip – slipped (excuse the pun) as a major issue? Ammonia due to safety dropped lower in preferences I think, and Hydrogen remains a challenge due to energy density.'

Methane slip did not, however, appear to be slipping down the agendas of the NGOs on the survey and Say No to LNG's **Elissama Menezes** gave the most detailed response on this score, saying: 'Here are five main reasons why LNG has no space on the shipping industry decarbonisation pathway:

'LNG is not environmentally effective: from a well-to-wake (lifecycle) approach, LNG does not reduce greenhouse gas emissions. Its significant methane emissions move the shipping sector farther away from the 1.5°C/Paris goal. LNG production also consumes billions of gallons of water, impacting local farmers and agricultural operations. Furthermore, if methane emissions are not

significantly reduced, we will see annual crop losses of up to 25 million tonnes.'

'LNG worsens global equity: climate change impacts from the methane emissions of LNG directly threaten the existence of Small Island Developing States (SIDS), Least Developed Countries (LCDs), and Indigenous Peoples. LNG shipping should be held accountable for its role in contributing to 25% of methane-induced global warming.'

'One could say that 2023 was the year that alternative fuels started becoming mainstream'

Jason Stefanatos, DNV

'LNG exacerbates local inequalities: contaminated drinking water and air quality from LNG facilities are exacerbating environmental racism in nearby low-income and racialized communities.'

'LNG impacts workers safety: oil and gas workers are exposed to seven times the risk of death compared to the average industry risk. Justice for workers also extends into their local communities impacted by LNG facilities.'

'LNG stunts zero-emissions solutions: as countries move towards net-zero emissions and technological inclusivity, wasted investments into LNG ships are estimated at \$850 billion by 2030. Investing in LNG as a shipping fuel diverts resources and momentum from achieving a globally sustainable and commercially viable zero-emissions shipping value chain.'

Looking ahead, Menezes anticipated that: 'In 2024, there will be a growing awareness of LNG greenwashing through increased scrutiny, legal action, regulatory changes, media coverage, educational efforts, and transparency. Furthermore, stakeholders in the maritime industry are already beginning to realize the financial pitfalls of investing in LNG infrastructure.'

Isabela Keuschnigg from Opportunity Green maintained that: 'There is a growing body of scientific evidence that strongly suggests that the lifecycle benefits in terms of greenhouse gas emissions savings when using LNG in shipping are marginal if not negative. This is particularly true when LNG is used to power cruise ships – due to engines and operating conditions, the use of LNG in cruise ships can increase lifecycle greenhouse gas emissions compared to conventional fuels.'

Like Menezes, Keuschnigg felt that: 'There are already good examples of first movers in shipping, such as Maersk, which has pub-

licly denounced the use of LNG and instead pledged to leapfrog to hydrogen-derived fuels.'

'Research by UCL,' she continued, 'has estimated that the global LNG-capable fleet runs at risk of stranded assets of \$850bn by 2030. As this financial risk crystallises, we expect other companies to follow with time.'

'Additionally, campaigning groups are increasingly drawing attention to this issue and calling out the harmful climate effects

of the uptake of LNG in shipping, as well as the legal and reputational risks of advertising investment in LNG to investors and consumers, such as the work Opportunity Green has done in filing complaints to the regulator for potential greenwashing from cruise companies around the use of LNG.'

Pacific Environment's **Antonio Santos** shared Menezes' objections to LNG, which he described as a 'stranded asset' and 'false choice' because of its methane emissions. Of the alternative fuels, he said he was pleased to see methanol raise its game in 2023, but urged the shipping industry to choose 'green methanol', which he said is 'the only truly sustainable option of the colour alternatives'.

He explained why: 'Grey and blue methanol, derived from fossil fuels (with an attached carbon capture and storage (CCS) system under the latter), still release climate-warming greenhouse gasses given methane leakage rates from natural gas infrastructure and transportation, as well as the limited efficacy of CCS systems.'

Keuschnigg's Opportunity Green colleague **Nuala Doyle** agreed with Santos on both methanol's growing popularity – and the importance of checking its provenance: 'The future of methanol as an alternative fuel has gained traction over the last year, with developments such as the maiden voyage of the methanol-powered *Laura Maersk* and increasing orders for methanol-fuelled vessels contributing to this rise in profile.'

'Of course, methanol has historically been produced using a fossil fuel feedstock. If it is to meaningfully contribute to lowering emissions as an alternative to traditional bunker fuel, only green methanol – produced using green hydrogen and carbon dioxide from direct air capture (DAC) – should be viewed as a viable option long-term.'

'While methanol may have "raised its game" this year, the policies and regulations supporting the adoption of green hydrogen-derived fuels for the shipping sector have not. If methanol is going to provide a long-term alternative to traditional bunker fuel, we need to see such regulations strengthened.'

Allyson Browne of HACC toed the NGO line on welcoming an uptake in methanol, but she emphasised that it must be 'e-methanol' specifically. Even 'green methanol' can be problematic, she said, as 'biomethanol may be lumped into "green methanol"'. She also urged the shipping industry to steer away from LNG.

'Due to its lower emissions and growing availability, methanol has seen increased interest in the shipping industry over the last year,' Browne said. 'It's a promising, relatively safe low-carbon liquid fuel, but we need to ensure that buyers are demanding green e-methanol (produced from green hydrogen and captured carbon dioxide), not biomethanol (due to its greater net climate impact). Because the fuel is liquid at room temperature, it's less costly to store and transport than gaseous fuels, and it has the lowest carbon footprint of all liquid fuels. It can be used in internal propulsion engines and to power fuel cells, providing a pathway to a future where liquid green hydrogen is used in fuel cell engines. Among others, Maersk has chosen methanol as its alternative fuel of choice (although it's using bio-methanol for its new methanol-enabled vessel), showing promise for a green methanol-powered shipping future.'

Turning her attention to LNG, Browne said that: 'Methane slip is happening at bunkering facilities and onboard vessels powered by LNG (as proven by investigations conducted by Transport & Environment). Furthermore, the extraction and processing of fossil gas, the source of LNG, often results in methane leaks, further contributing to its overall greenhouse gas footprint.'

Browne concluded: 'This undermines the purported climate benefits of LNG as a transition fuel and puts into serious question its role in the maritime industry's path to decarbonisation.'

The debate over methane slip is likely to continue, but many involved in the LNG business are now focusing on 'green LNG'.

Steve Esau of SEA-LNG told us that: 'Green LNG has raised its game this year. Bio-LNG supply is scaling rapidly, and several production and liquefaction plants are expected to come online in the next two years. Plus, based on our research and using the latest DNV data, bio-LNG bunkering is already available today in almost 70 locations in Europe, North America, and Asia. This is reflected in our **Bunker**

Navigator map-based tool which shows LNG and green LNG bunkering locations.

'Production of biomethane, from which bio-LNG is produced, is currently running at approximately 30Mt pa, or 10% of shipping's total energy demand. Biomethane production in Europe grew by almost 20% in 2022 compared to the previous year, according to data from the new edition of the **EBA Statistical Report**.

'Looking at renewable synthetic e-LNG – that's LNG derived from renewable hydrogen, also known as e-methane – the first supply signals are already appearing. This year, SEA-LNG member Gasum and Ren-Gas have signed an e-LNG offtake agreement. Nordic Ren-Gas's Power-to-Gas plant in Tampere will produce annually 160 GWh of renewable e-LNG, which Gasum will procure and distribute to its customers.'

Casting his eye over the other fuels, Esau judged that: 'While orders for methanol-fueled vessels in 2023, including retrofits, slightly exceeded those for LNG propulsion, we expect methanol to have lost some momentum towards the end of the year. After an initial flurry of orders, perceptions have changed slightly, and more stakeholders have started to recognise that methanol is not a 'silver bullet' – in fact its decarbonisation pathway has significant grey areas that must not be overlooked.'

'Firstly, when you burn any methanol, you emit CO₂. There is also a growing recognition that currently all the alternative fuels available at scale are fossil (grey). Grey methanol has worse well-to-wake emissions (estimated at 14% higher) than VLSFO (very low sulphur fuel oil). By contrast, grey LNG reduces up to 23% of GHG emissions (including methane slip).

'As a result, large amounts of green methanol are required to simply achieve emissions parity with VLSFO, let alone grey LNG. This places greater pressure on the supply of green methanol, which like all green fuels is a scarce resource. Plus, there is already a concerning imbalance between the projected supply of and demand for green methanol. In late 2023, CMA CGM indicated that these grey areas were of concern to it, switching eight 9,200 TEU container ships on order from methanol to LNG propulsion.'

Titan's **Michael Schaap** also flagged up the progress of bio-LNG – or liquified biomethane (LBM) – as production of the fuel 'began to scale worldwide'.

'At Titan,' Schaap recounted, 'we have made progress on two large LBM plants. The FirstBio2Shipping plant is under construction in the Netherlands, it will produce around 2,400 tons of high-purity LBM per year, and production is expected to start in Q2 2024.'

'Progress is also continuing on the world's largest biomethane liquefaction plant in the Port of Amsterdam. The plant will ultimately produce up to 200,000 tons of LBM per year. The bulk of the LBM produced will be supplied by Titan to a major shipping liner to power its LNG/LBM-fuelled fleet, where it will substitute fossil fuels to cut GHG emissions.'

Titan has a foot in various clean marine fuel camps, and Schaap was pleased to report that: 'Notable progress was also made on methanol in 2023. With our commitment to delivering all the fuels that can decarbonise shipping in a substantial way, including any hydrogen-derived e-fuel in the future, we are excited to see methanol infrastructure and vessels develop. However, we must be cautious and pay attention to the colour of fuels; grey methanol will actually increase emissions over traditional oil-based marine fuels.'

Schaap added: 'The latest data from DNV's Alternative Fuels Insight (AFI) platform found that a total of 298 ships with alternative fuel propulsion were ordered in 2023 – an 8% increase year on year – so it could be argued that no alternative fuels are really losing ground. Having said that, relatively, 2023 was a strong year for methanol. The year saw 138 methanol orders including retrofits, compared to 130 LNG-fuelled vessel orders. When looking at newbuilds alone, LNG would be in the lead, and there are now over 1,000 LNG-powered ships in operation or on order. Hopefully, this healthy competition will propel the uptake of both alternative fuels and drive progress along each fuel pathway.'

While most of our respondents seem to come down on the side of either methanol or LNG (or in Titan's case both), Shipping Strategy's **Mark Williams** believed that ammonia has been upping its game, saying: 'The first ships with ammonia ready engines were ordered in 2024, as were the first very large ammonia carriers. Producers of green ammonia like Yara made progress on financial investments. The fuel remains unpopular in some quarters due to its toxicity but ammonia carriers have an exemplary safety record to date.'

'Methanol seems to have lost ground somewhat, mostly to biofuels which are easier to drop in to current engines. Methanol is still a hydrocarbon fuel albeit with lower CO₂ but there are those who think why not skip the intermediary step and go straight to ammonia which is a hydrogen carrier. Methanol will have its place but it is not apparently going to be as widely adopted as had been expected.'

UNCTAD's **Jan Hoffman** felt that ammonia has been gaining ground. 'It is not that I would endorse or have a strong view in favour of ammonia,' he explained, 'but during several

events I joined in 2023, including at COP, the IMO and private sector conference, ammonia was more prominently presented as a solution than what I was made aware in earlier years.' Hoffman added that: 'With a focus more and more on well-to-wake solutions, LNG is really more of an intermediate solution, only.'

MakingSense's **Kasper Sogaard** also saw more prominence for ammonia amidst a general progress for the transition. 'All alternative fuels are seeing increased interest in light of the clearer policy signals coming out of the IMO and the EU and the stronger customer demand for zero emission shipping from the likes of Amazon,' he said. 'Ammonia and methanol grew in prominence as leading long term fuel options in line with technical developments and new build orders, whereas hydrogen as a deep sea fuel still seems to be uncertain.'

Raal Harris of Ocean Technologies Group agreed with Sogaard that 'methanol and ammonia have both shown strong progression in the last year' - but he believes that: 'It's becoming increasingly clear that there will be no single fuel of the future. The ability to produce fuels in sufficient quantities to meet the needs of wider industry means that we will be looking at mix of new fuels and related technology. This will pose significant challenges in ensuring our maritime professionals are sufficiently prepared to work safely and efficiently.'

Environmental Defense Fund's **Panos Spiliotis** and **Sofia Esquivel Elizondo** also chose not to pick any single fuel, reasoning that: 'Each alternative fuel option has its own set of advantages (e.g., higher energy density compared to other options) and disadvantages (e.g., elevated toxicity or higher production/handling costs). Therefore, rather than directly competing, these fuels hold the potential to complement each other by addressing specific needs while taking advantage of regional feedstock availability. However, it is important to identify and address knowledge gaps and potential risks to enhance their efficiency, safety, and affordability.'

Steven Jones of the Sustainable Shipping Initiative also looked forward to a multi-future where there will be no one winner but 'winners in their own particular domain and use cases'. But he emphasised that: 'The solutions need to be fit for purpose, and as there is no real one-size-fits all approach, then we need the willingness and wisdom to pick the right pathways.'

'There needs to be the ability to rely on supply, to be able to manage costs and factor these into business,' Jones continued. 'Then comes the matter of actually, genuinely moving toward a zero emission and sustainable fuel future, which means dealing not only with the emissions at the point of combustion but

well-to-wake emissions, labour rights in the production process, environmental factors such as air quality and water and land use.'

So, this becomes a question of suppliers, of costs, of infrastructure, of the willingness to research and develop, of the capabilities which come from investment, and of the real emissions produced. All these need to be addressed, factored in and dealt with.'

RINA's **Tom Barlow-Brown** was one of the few respondents to say that ammonia may not have made progress in 2023 - but added that the same might be said of some of the other alternative fuels because they are 'still in their infancy', which 'for now is dissuading people from taking them onboard en masse'. In contrast, Barlow-Brown said: 'LNG appears to have been on the rise again as it is the most commonly used and best understood.'

'Although LNG still makes up the largest fraction of newbuild orders, the increase in methanol dual fuel vessels shows a promising alternative path to traditional bunkers'

Almanda Terese Molter, Monjasa

Nicholas Woo of Birketts, however, believed that: 'There are more and more dual fuel use vessels coming online for methanol and hydrogen.' He also flagged up that NYK is both investing in ammonia-fuelled ships and ammonia supply chains - but added a note of caution: 'It remains to be seen what will happen. 2024 is too soon to tell.'

Baseblue's **Dyonisis Diamantopoulos** also emphasised that some alternative fuels have much ground to make up. 'I wouldn't say that any alternative fuel actually lost ground per se,' he told us, 'but due to the reality and the current state of affairs and readiness, ammonia as well as hydrogen, are considered fuels that would play a role later in time along the line.' By contrast, he considered that biofuels have raised their game 'due to the fact that biofuels are the immediate solution in matters of both availability and ability of existing fleet to burn with minor changes'.

'In 2024,' he continued, 'we will surely see intensified efforts of physical suppliers to increase the availability of biofuels and infrastructure of such. We are expecting more ports to adapt and supply and at the same time surpass any challenges connected either to local product availability or legislative measures related to biofuels bunkering. We have already experienced an increased interest across all

types of biofuels and different blends due to the willingness of clients to conduct trials or in the context improving the CII of specific vessels.'

Drew Marine's **Albert Leyson** also expected the coming year to be good for marine biofuels as: 'More and more ship operators have indicated that they have successfully trialed biofuels and intend to do additional longer-term trials in 2024.'

Nautical Supply International's **Karl Shrowder** said that while marine biofuels have been around for years, we are now seeing the interest turned into demand as 'HBE-Gs, Dutch biotickets certainly played and are still playing an instrumental role in their uptake in North West Europe (NWE) and 'suppliers and shipowners are becoming more familiar with the product'.

'Despite the phasing down of Dutch bio tick-

ets,' he continued, 'we will see demand remain stable despite competition from other sectors like aviation and road transport. However, new bio-based feedstocks may emerge to help meet shipping demand similar to pyrolysis oils that other sectors will not demand yet would need to be added to existing specifications. Moreover, further technological developments are required before these fuels can be stable enough to be in the marine sector. In 2024, we will see suppliers with storage and product ready to deliver to their customers who want the option to boost their environmental ambitions like container liners and cruise ships.'

IWSA's **Gavin Allwright** began by suggesting that our proffered alternative marine fuel palette was too limited: 'We would add wind propulsive energy to this list, and the direct use of wind energy has been recognised in IMO as a "fuel" pathway, one that is zero-rated for all emissions, not only GHG emissions, thus would be a prime candidate as the baseline energy source.'

'If wind is included in the list, then it becomes one of the front runners in that 32 large ships are now running partially on wind power and another 11 are "wind-ready" with 16+ more pending for delivery in early 2024 whereas very little tonnage is running on low emissions fuel outside of biofuels and LNG. We would say

that 2023 saw wind propulsion raise its game and laid a solid foundation for 2024/5 where we will likely see an inflexion point reached.'

Turning to the competing fuels, Allwright said: 'Methanol has had a lot of press with a substantial number of vessels being delivered or on order as "dual-fuel" vessels (as with other fuels), but that doesn't mean that affordable, non-fossil fuel feedstock will be available at the volumes required for those ships to operate on those fuels and that is an issue across the "new fuels" spectrum. Biofuel is a drop-in option that has seen volumes rise quite substantially and LNG continues to grow, though more slowly it would seem. However, the discussions around infrastructure build out that we have had this year certainly points to bio-LNG being a contender going forward as this is again in great part a drop-in fuel. LNG has also recovered to a degree from the price spikes of 2022 and early 2023 which sent the signal to shipping companies that this was a volatile and risky option during that period.'

But Allwright emphasised that: 'IWSA remains fuel neutral, and wind propulsion is compatible with all of these options. Thus it is difficult to break through the marketing veil surrounding each of these and see which ones are losing out. However, the construction numbers of vessels would indicate that the direct use of hydrogen for large ships at least is lagging behind the others. Ammonia has made ground even though the regulatory framework and safety and environmental concerns haven't yet been addressed fully.'

Which fuel do you think will be the number one marine fuel (in terms of volumes sold) in 2030, 2040 and 2050?

We suggested the respondents might choose from among a shortlist of traditional bunkers, biofuels, ammonia, methanol, hydrogen and LNG – but were open to alternatives.

DNV is often quoted as a useful authority on this subject, both for its Maritime Forecast and its Alternative Fuel Index, so we'll begin with **Eirik Ovrum**, who told us: 'Based on the research and projections from our Maritime Forecast to 2050 report, we expect "traditional bunkers" will be the most sold fuel in the short term. In 2030 our projected demand for carbon-neutral fuels at a level that satisfies IMO goals is less than 10% of the total.

'If onboard carbon capture is successfully deployed and the land-based CCS industry develops as planned over the coming few years, then the combination of being able to use about 30% fossil fuels with carbon capture (by 2040 IMO goals) and using fossil fuels with onboard carbon capture,

could mean that "traditional bunkers" will still hold the biggest share into the 2040s.

'Looking out towards 2050, we simply cannot answer the big technological questions that need to be resolved. Will there be an abundance of renewable energy and a dramatic improvement in electrolyser technology to allow for low cost and abundant ammonia or hydrogen? Will there be enough biomass to fuel shipping? Will onboard carbon capture be a large-scale success? That's why in our DNV's Maritime Forecast to 2050 we cover some 24 different scenarios for the fuel mix.'

Mark Williams expected to see traditional bunkers keeping their top spot in 2030, after which alternative fuels will muscle in. Regular readers of his shipping market outlook in the *Bunkerspot* magazine will know that Williams has a keen eye for data, and he concluded that: 'The global shipbuilding industry can't build enough ships by 2040 for the majority of ships to be ammonia or hydrogen. So there will be a role for traditional bunkers but liquid hydrocarbons will include biofuels and RFNBOs. It seems increasingly likely that carbon capture will have to play a role. By 2050 the balance should have shifted with the majority of fuels for sale being hydrogen carriers like ammonia.'

Kasper Søgaard also saw a move to ammonia by 2050. He set out the journey: 'In 2030 traditional fuels will still dominate as even the most ambitious IMO target only calls for 10% zero emission fuel by 2030. 2040 is to me very uncertain as it really depends on how quickly alternative fuel production ramps up as it will be impossible to transition without the fuels being available and here shipping will also be competing with other industries.

'In a zero in 2050 scenario as agreed by the IMO and assuming the necessary regulation to make this commercially viable is adopted, I would see ammonia becoming the dominant fuel as it will be the cheapest synthetic fuel to produce at the scale needed for shipping. This however will require all safety issues to be resolved.'

Nigel Draffin expected to see methanol take a strong position in 2040, and ammonia in 2050, as he explained: 'The sheer number of vessels will dictate the volumes and as traditional vessels that can will refit for methanol rather than those that need more complex storage, and ammonia engines will not become mainstream until after 2030; but by 2050 we will have synthetic ammonia and synthetic methanol which will probably have equal dominance.'

Namrata Nadkarni of Intent Communications also picked methanol for 2040 and ammonia for 2050, but predicted a strong showing early showing for biofuels. 'I think that at 2030 a lot of the fleet will be existing ships, meaning that

biofuels will be leading the pack – with LNG a close second,' she said. 'By 2040, I think methanol should have cornered a lot of the market, particularly for containerships where it is increasing in popularity amongst new builds. And by 2050, ammonia will be dominating the market as a fuel in its own right as well as a means to unlock green hydrogen.'

RINA's **Tom Barlow-Brown** expected LNG to have built up a good market share by 2030, but he didn't feel 'knowledgeable enough to forecast what the situation would be in 2040 – 2050'.

Given his position at Baseblue – part of one of the world's biggest bunkering concerns, **Dyonisis Diamantopoulos** certainly has considerable market knowledge – but he nevertheless prefaced his comments with the caveat that: 'There is no crystal ball and there is nothing that is set in stone or is definite in the aspect of the fuel mixture of the future.' He then continued: 'From the current trajectory of the matters, it seems there still is not a silver bullet and a single type of fuel that will dominate at least for the proximate and medium-term future. We are observing an uptake of interest in biofuels as expected, since existing fleet can adapt and consume with minor modifications and fine tuning of vessels.

'For sure, the conventional fuels will not immediately lose any substantial ground or phase out in the following years and will still remain as a big part of the industry even while biofuels gain ground; let us not forget that biofuel blends do consist partly of conventional fuels either HSFO, VLSFO, MGO, or LSMGO. LNG will also have its share since there are and will be even more vessels – besides the LNG carriers that are able to consume their cargo – with dual-fueled engines.

'Alternative fuels such as methanol (green/e) and ammonia (green/e), fuel cells, or hydrogen would be considered as "future fuels" with no certainty on the trajectory of the development of readiness, availability, and infrastructure for the future. From the side of the international and regional bodies (UN, IMO, EU Commission) we already see though that there are clear targets and push towards clean energy with goal to eliminate GHG emissions by 2050.'

Monjasa's Energy Regulatory Specialist **Almanda Terese Molter** judged that: 'Traditional bunkers will still be the most common fuel choice both in 2030 and 2040, as the fuel mix of the future will consist of fuel diversification. Consequently, comparing traditional bunkers to low-carbon bunkers overall, alternative pathways are expected to collectively make up a majority in 2040. If Ammonia proves applicable and safety concerns are sufficiently addressed, it is expected that

this fuel pathway will become more dominant due to its unquestionable advantages.'

Anthony Mollet of the Marine Fuels Alliance expected to see traditional bunkers remain the main marine fuel up to 2040, but predicted that, with 'the inevitable increase in regulation and regional requirements' it was likely that 'fully sustainable biofuels' – developed by advances in technology and production – will 'ultimately become the main marine fuel by 2050'. He concluded: 'Strict targets have been set and governments and international organisations are determined they are met and upheld.'

'All alternative fuels are seeing increased interest in light of the clearer policy signals coming out of the IMO and the EU and the stronger customer demand for zero emission shipping from the likes of Amazon'

Kasper Søgaard, MakingSense

Steve Esau set out a detailed pathway, based on a progression from LNG to bio-LNG to e-LNG. 'To achieve decarbonisation targets,' he said, 'shipping will require a basket of fuel options. We expect LNG, bio-LNG, and biofuels to be prominent in that basket in 2030. Bio-LNG is liquefied biomethane and is chemically identical to LNG, so it can be dropped into existing LNG supply infrastructure and vessels with no changes required, and it can also be blended with conventional LNG at any ratio.'

'To sell large volumes of an alternative fuel in 2030, the shipping industry will need the infrastructure for that fuel; availability is not just about supply but also about infrastructure. LNG's global bunkering infrastructure continues to expand, extending bio-LNG's head start. According to Clarksons, some 188 ports offer LNG bunkering services, with a further 82 bunkering locations implementing plans or under active discussion.'

'The number of LNG bunker vessels has grown from 40 at the end of 2022 to 50 with a further 34 on order or under discussion. 2023 has seen new LNG bunkering vessels coming into operation in Japan, Korea, Singapore, the US East Coast and the Gulf of Mexico, NW Europe and the Mediterranean.'

Looking further ahead, Esau maintained that: 'Net-zero bio-LNG will remain an attractive option from a GHG emissions standpoint in 2040, 2050 and beyond. Emissions reduction will depend on how the bio-LNG is produced and the engines in which it is used. In general, the use of bio-LNG as a marine fuel can reduce

GHG emissions by up to 80% compared to marine diesel on a full well-to-wake basis. If avoided emissions are taken into account, bio-LNG, when it is produced from anaerobic digestion of manure, can achieve negative emissions of up to -190% compared with diesel.'

'By 2040, we hope to see some renewable synthetic e-fuels, including e-LNG, e-methanol and e-ammonia starting to properly emerge at a larger scale. We are unlikely to see commercial quantities of e-fuels until the renewable electricity and electrolysis capacity, required to produce the common green renewable

hydrogen feedstock, is scaled massively. This is unlikely to happen before 2030 and will take well into that decade to scale significantly.'

'The scale of the e-fuel challenge is breathtaking, due to the huge demand for renewable electricity to create the new electro-fuels and competition for those renewables. The International Chamber of Shipping estimates the shipping industry will need as much renewable energy as is currently produced globally – up to 3,000 terawatt hours (TWh), to reach its net-zero goals. This is more than the total EU electricity demand of 2,809 TWh6 and three-quarters of the 4,048 TWh total US electricity demand.'

And what will the market look like in 2050? Esau judged that: 'It is hard to predict the future fuel mix in 2050 as many commercial, technical, economic, and regulatory uncertainties remain. Similarly to 2040 predictions, we expect LNG, bio-LNG, and e-LNG in various blends to be more commoditised and commercialised marine fuels in widespread use across the industry.'

'E-LNG may be slightly more used than other e-fuels as it could have a slight price advantage over alternatives because of its established infrastructure. Renewable hydrogen production makes up around 70-80% of the costs of e-fuels, such that the difference in production costs for the different fuels is not expected to be significant. However, some e-fuels such as e-ammonia and e-methanol may still require some investment to mature the engine technology and global

infrastructure that will support them. Other e-fuels, like e-LNG, already have a growing fleet of vessels and infrastructure in place.'

'When assessing decarbonisation options for the maritime sector, it is essential that the pathway is evaluated not simply the destination. All alternative fuel pathways share a common net-zero or zero-carbon destination, but the cost, emissions and timelines are key considerations. The LNG pathway offers a safe, proven, practical, low-cost and low-risk incremental pathway to decarbonisation via bio-LNG and renewable synthetic e-LNG.'

Titan's **Michael Schaap** also predicted a bright future for LBM and later e-LNG. 'In 2030,' he said, 'we expect LBM to have a higher market share than it currently does. By 2030, with regulations such as the European Union's Emissions Trading System (EU ETS) set to have tightened, the rationale and incentives for adopting cleaner and greener fuels should be even clearer. The infrastructure and availability of LBM continues to expand worldwide too. This LBM will likely be "dropped in" and blended with conventional LNG to reduce emissions in line with availability and regulations. If this outlook becomes a reality, the IMO's aim of reducing shipping emissions by at least 20% by 2030 compared to 2008 levels would be in sight.'

'In 2040,' Schaap continued, 'we expect to see LBM take an even larger market share and to form a higher proportion of blends with conventional LNG. We also anticipate pure bio-LNG bunkers, which will be net-zero or even net-negative if avoided emissions are taken into account. We also hope that hydrogen-derived e-methane (e-LNG) and e-methanol, produced using renewable electricity and electrolysis, will be entering the market and the fuel mix. The reality is likely to be that traditional oil-based fuels will still be in use, but that these fuels are less commercially viable due, in the main, to taxes. The IMO's aim of reducing shipping emissions by at least 70% compared to 2008 levels by 2040 is a real challenge, and the industry would need e-fuels to be materialising at this point to achieve the major emissions reduction.'

'In 2050, if net-zero shipping emissions are to be achieved in line with the IMO's targets, we will need a mix of net-zero and zero-emission fuels. It is likely that some fuels will be more suitable for some ship types and operating profiles than others. The passenger shipping sector, for example, is unlikely to use green ammonia – (barring any major safety breakthroughs) – and instead may focus on green LNG as it has a proven safety record and almost entirely reduces local emis-

sions such as sulphur oxides (SOx), nitrogen oxides (NOx) and particulate matter (PM).'

Allyson Browne of HACC would like to see a full commitment on low- and zero-carbon fuels. 'I hope to see LNG sales flatten and decline significantly well before 2030, especially given our need to peak global emissions before 2025 (the end of THIS YEAR),' she said. 'To achieve this ambition, we need significant supply and demand commitments from the industry to support the scale-up of low- and zero-carbon fuels including e-methanol and green hydrogen. Initiatives like coZEV's Zero Emission Maritime Buyers Alliance are key to aggregating early demand in the sector, and provide market certainty for suppliers. But we need regulatory (policy) and financial support at the local, regional, national and international levels to really accelerate this transition. Policies like the EU's FuelEU Maritime (fuel standard) and the forthcoming GFS under the IMO basket of measures can drive uptake by mandate, and financial support mechanisms can ensure the transition is swift, just and equitable.'

'After 2030 it is anyone's guess what will be the major fuel used as it will be wholly determined by the regulatory requirements put in place this decade that will determine the economic case for investment in alternative fuelled/propelled ships'

Edmund Hughes, IBIA

IBIA's **Alexander Prokopakis** kept it brief: 'There will not be enough vessels using alternative fuels until 2030 in order to surpass "traditional bunkers". As of today this seems to be true for 2040 as well but we have time ahead of us to see.' His IBIA colleague **Edmund Hughes** agreed that traditional bunkers will still be the number one fuel in 2030 – again, because there won't yet be enough ships capable of using the alternatives – but he added: 'After 2030 it is anyone's guess what will be the major fuel used as it will be wholly determined by the regulatory requirements put in place this decade that will determine the economic case for investment in alternative fuelled/propelled ships. Furthermore demand from other sectors for certain alternative fuels will dictate their availability/cost for shipping which will again need to be built into any investment decisions by ship companies.'

Nicholas Woo of Birketts was another who felt that traditional fuels will still be the mainstay of the bunker market as 'six years is too

short a time for a realistic transition bearing in mind that at least half the world's tonnage who are owned by SMEs are not involved in the current trend that is widely reported by the larger shipowners'. He ticked methanol for 2040 'as a hope, not a prediction', adding that: 'The main concern is the SME shipowner which no-one appears to have paid any attention to.' The question of which fuel will be dominant in 2050, however, he said is 'totally speculative and cannot be answered'.

As the owner of 2050 Marine Energy, **Adrian Tolson** probably feels that answering that question is very much his stock-in-trade, and he told us: 'I think it may well be traditional bunkers as the main fuel at least until 2040 and even to 2050! Methanol and LNG will be number two through the decades and ammonia – if safety issues are resolved – perhaps number two by 2050. Biofuels will never lead: I think this remains a consistent drop in solution for traditional bunker fuel burners needing to drop emissions quickly. Perhaps it will always be the expedient but expensive solution?'

Drew Marine's **Albert Leyson** expected biofuels to play a bigger role in the transition. 'I think conventional bunkers will continue to prominently be used up to 2040, at which point, biofuels would become more widely adopted due to wider availability,' he said. 'By 2050, the methanol-ready ships that are currently being built in the 2020s could become the leading fuel in terms of volume as restrictions on traditional bunker and bio-fuel emissions come into play. Key factors for all possible fuels include sufficient scale and availability on the supply side along with the required investment in infrastructure. It's entirely possible that the leading type of fuel used may be defined by ship segment type and the maturity of port bunkering infrastructure.'

Steven Jones would not be drawn into naming winners, instead emphasising it will come down to picking the solutions that work best and can be delivered at scale. 'We need the volumes of the right fuels we need to be available, to be cost efficient, and to be delivering on

promises,' he summarised. 'With those parameters met, then the right fuels will be the ones that are sold the most – whatever they may be.'

Nautical Supply International's **Karl Shrowder** saw tradition fuels remaining a key feature of the marine market and thought the key factors in the energy transition will be: 'using the sophistication of technology to quantify emissions' in the immediate term; 'technical improvements of fleet and/or drop in fuels' in the short term; ship based carbon capture (SBCC) in the medium term, and renewable fuels of non-biological origin (RFNBO) in the long term. 'I would love to put e-methanol as the dominant fuel in 2050,' concluded Shrowder, 'but the supply will still not be ready to meet demand which will still be gazumped by traditional fuels, being produced in a more efficient way to reduce the carbon intensity from WtT standpoint, and commercial viability in SBCC will help mitigate downstream (TtW) carbon emissions.'

Gavin Allwright first made the case for 'wind propulsion as being a very serious contributor to the energy mix here by 2030' and judged that: 'Outside of an extreme set of events (market/environment) and a wholesale ratcheting up of regulatory measures, I can't see a situation where traditional bunkers are supplanted by 2030, which is only six years away. They will remain the cheapest option by far, even after EU ETS starts to really bite by 2026 and a global levy of some form comes into being in 2027/28.'

Our question about 2040, continued Allwright, was: 'Far trickier to answer, if fuel based green corridors (as opposed to wind based green corridors) development is successful and the price of alternative fuels drops or is mitigated then alternative power to X fuels may come into their own. Biofuels and bio-LNG are likely to be attractive to the industry due to their drop in nature. However, this will also be determined by regulatory restrictions when full well-to-wake emissions life cycles are assessed.'

'The key here,' Allwright said, 'is not necessarily which fuel will be dominant, but which fuel will be derived from "green" rather than "black" or other coloured feedstock.'

By 2050, Allwright continued: 'We will have to have moved away from pretty much all fossil fuel derived fuels by this time, perhaps with some level of CCS in the mix. This isn't only due to current regulations around GHG emissions, but there will likely be increased focus on non-GHG climate impacting emissions such as Black Carbon, VOCs, fugitive H2 emissions, underwater radiated noise etc. This focus could also affect the choice of alternative fuels and certainly strengthen the case for wind propulsion as a key part of the energy mix in 2050.'

Tech talk

Our ship.energy survey respondents give their views on how technology can help increase energy efficiency and reduce emissions

While most agree that the shipping industry will have to transition away from fossil fuels in order to achieve its long-term zero-emissions goals, there is also much that can be done to improve vessels' energy efficiency (even if they are still running on traditional fuels) and reduce their emissions.

Is onboard carbon capture gaining more credibility as a viable option for reducing ships' emissions?

Nick Brown of Bureau Veritas gave us the most detailed answer: 'Onboard carbon capture is increasingly gaining credibility as a viable solution for reducing ships' emissions. A recent joint study involving Bureau Veritas, Wah Kwong Maritime Transport Holdings, and Shanghai Marine Diesel Engine Research Institute (SMDERI) demonstrated the technical feasibility of retrofitting carbon capture and storage (CCS) technology to enable older in-service vessels to maintain compliant CII

ratings until 2030. However, it is important to note that this remains a theoretical assessment, because whilst guidelines for CCS are under development at the IMO, there is currently no provision for deducting the captured CO₂ in CII calculations. The project focused on two existing bulk carriers, a Capesize and a Supramax vessel. Following this study, an AiP was granted by Bureau Veritas, adding an extra layer of validation for this technology.

'Critically, this case study has proven to the maritime industry that retrofitting CCS technology is not only technically feasible, but also makes financial sense. A high level CAPEX and OPEX analysis was carried out and determined that no financial sacrifices would have to be made. The project also calculated the potential savings under EU ETS and the value of the captured LCO₂ if it was sold as a commodity for reutilisation within a circular economy.

'The successful decarbonisation of the shipping industry hinges on mitigating the emissions released by ships.

The lack of zero emission fuels currently available means that technology such as onboard carbon capture will likely be part of the mix. There are tens of thousands of ships operating today, and our joint study with SMDERI and Wah Kwong has shown that it is possible to cut CO₂ emissions by 30% through CCS retrofitting. This CO₂ reduction through CCS can potentially be implemented at a faster pace than the time needed for the production, ramping up and update of zero-carbon fuels in the short and medium term, meaning that onboard CCS can be a prominent candidate during the transition.'

Dyonisis Diamantopoulos of Baseblue was positive: 'Carbon capture is a promising technology with the aim to reduce emissions by the method of capturing and storing carbon aboard vessels. Whilst the technology is indeed promising in theory, there should be close considerations and assessments of feasibility and scalability of the technology. In order



for this to make sense, there should be such a way or technology of carbon capture that:

1. We will have the capacity to capture a sizable amount of carbon emissions and store them.
2. Cargo capacity should not be compromised to an extent that it would not make sense to have this technology.
3. There should be infrastructure that would allow vessels carrying such technologies on board to be able to discharge in a wide array of ports around the world.
4. Mechanical considerations should also be done in the context of the installed carbon capture technology that doesn't deteriorate the wear and tear of the piping, systems, funnel, or machinery.

'Taking all of the above in account, if there would be such a technology that would address all, the concept of carbon capture is indeed promising and could be a solution for the further capture/reduction of emissions in the maritime industry.'

Houlder's **Sean McLaughlin** saw real potential for the technology. 'It's clear that the shipping industry, like land based "hard to abate" industries, are increasingly seeing carbon capture as an essential component in meeting decarbonisation targets,' he said. 'The opportunity for onboard carbon capture is significant. Sequestration projects are developing at pace to meet the enormous potential demand, and there is also an increasing industry requiring supplies of CO₂. Not least of these is the growing number of methanol plants seeking to address the potentially huge demand for green methanol. Not only do these plants require an adequate supply of green hydrogen but they also rely on a supply of appropriately sourced CO₂. Carbon capture is an essential part of this supply chain and if shipping can lock in captured carbon taking it from its own emissions and delivering it to e-methanol plants, then the potential role for methanol in the long-term decarbonisation of shipping grows enormously.'

'As onboard carbon capture gains traction, almost every ocean-going ship type has the potential to become a CO₂ carrier too. This brings the challenges of CO₂ shipping into the scope of many more ship owners. It will no longer be just ship owners who plan to build dedicated CO₂ carriers that need to be aware of, for example, CO₂ purity and containment requirements.'

Chara Georgopoulou shared some information on how DNV is helping to support the technology, and told us: 'OCC systems are gaining attention as viable decarbonisation options to meet the stringent upcoming regulatory limits, especially

as retrofit options. Shipping is facing a great challenge to decarbonise operations and technology providers have already been working on providing technically feasible solutions in this direction. In this context, a wide range of OCC solutions is being proposed by the market, addressing drastic CO₂ capture rates, and utilising different technology concepts, from amine-based scrubbing to mineralisation and cryogenic separation.

'Technology viability, however, is not only related to the carbon emissions reduction potential, but is also related to safe operations, economic attractiveness, and supply chain integrity. In this regard, DNV has produced OCC guidelines to support the industry efforts towards safely implementing OCC onboard ships. Furthermore, the industry is moving towards the development of collaborative schemas to test out the OCC technology through pilots. And, finally, we see developments on the regulatory framework, including the decision of IMO to address OCC in the next MEPCs, and the inclusion of OCC in EU ETS.

respect to addressing space and storage onboard the vessel and infrastructure in ports as to where the carbon goes after capture onboard vessels. Additionally, onboard carbon capture cannot become viable to the extent that it slows real progress with alternative fuels.'

IBIA's **Alexander Prokopakis** expected to 'see great developments around carbon capture in the next decade', while **Edmund Hughes** noted that: 'OCCS is now very much on the agenda at IMO and due to be discussed again in March.'

Meanwhile, the Sustainable Shipping Initiative's **Steven Jones** informed us that: 'Pilot schemes and trials of onboard capture systems have shown much promise, and they could indeed drastically cut emissions.'

'Indeed,' Jones continued, 'carbon capture may well be an essential part of the tool kit to allow us to reach net zero emissions. Challenges remain, including high capture costs and developing adequate CO₂ storage facilities on ship and in ports. But with more ships testing and validating these systems and

'Onboard carbon capture is increasingly gaining credibility as a viable solution for reducing ships' emissions'

Nick Brown, Bureau Veritas

'To conclude, we are experiencing a dynamic era for the OCC implementation in shipping and collaboration is the key to ensure future readiness.'

Nigel Draffin identified a particular area of strength for the technology, predicting that it will have a serious role to play in short sea shipping where onboard capture and easy transfer of the CO₂ to shore will favour vessels on these routes.

Adrian Tolson of 2050 Marine Energy also considered that onboard carbon capture would have some strong niche applications, as 'it will only suit certain types of shipping with regular ports of call in which to discharge carbon'. While he pointed out that we still have to decide 'what do we do with all the carbon once we have captured it', Tolson felt that the technology will 'continue to develop and will ultimately be a steady contributor to lowering overall CO₂ emissions'.

Monjasa's **Almanda Terese Molter** felt that onboard carbon capture had potential, but cautioned that: 'There is still far to go with

classification societies developing safety criteria and construction rules, onboard carbon capture is gaining credibility for shipping.'

'To the chagrin of decarbonisation purists,' said **Mark Williams** of Shipping Strategy, 'Carbon capture is going to have to be used to mitigate the worst effects of climate change. The question is, should captured carbon be stored or recycled into new RFNBO? Probably both will happen.'

As Williams intimated, many climate campaigners feel that carbon capture can deflect attention from the key goals of decarbonisation – and some of Survey respondents reflected this view.

For Say No to LNG's **Elissama Menezes**: 'Carbon capture technologies are as much of a distraction to the maritime sector as LNG. It is an energy-intensive process, and the numbers don't add up. Carbon capture technology has been used to justify the continuation of fossil-based marine fuels. According to IEEFA [the Institute for Energy Economics and Financial Analysis], there have been more

failed and underperforming carbon capture projects than successful ones. There are more cost-effective and efficient ways to reduce emissions in the maritime industry.'

Antonio Santos of Pacific Environment agreed. 'While onboard carbon capture has emerged as a potential strategy to reduce GHG emissions from ships,' he said, 'the shipping industry should not be investing in technologies that support the continued use of fossil fuels into the future. Ships fuelled by LNG, which are likely candidates for OCC, will take us on a detour on the road to full decarbonisation of the shipping sector. The climate emergency is too urgent not to go as directly and rapidly as possible toward zero-emission solutions like green e-fuels and electrification.'

Allyson Browne of HACC was concerned that: 'Onboard carbon capture and storage is not a long-term viable remedy for shipping's fossil fuel addiction – it's an enabler for it. We must be focusing investments on transitioning fleets and energy sources to low- and zero-carbon options, and reserving carbon capture for applications like the production of e-methanol and capturing carbon that's already in the atmosphere.'

Namrata Nadkarni of Intent Communications reasoned that: 'While CCS is certainly gaining more popularity onboard ships, I don't feel that it has gone up in credibility as a viable option. It is expensive and often energy intensive, meaning that it is not really a good match for the maritime sector as compared to other solutions. I do think that it will end up on ships in the long term, but I think that – in an ideal world – it would evolve a bit more on land ahead of making its way onto vessels.'

Drew Marine's **Albert Leyson** pointed out that onboard carbon capture was currently hampered by both a lack of credibility (in some quarters) and a lack of supporting infrastructure. 'I don't believe onboard carbon capture gained any more credibility in 2023,' he explained, 'because the perception is that carbon capture enables conventional fuels to continue to be used. So instead of winding down the use of conventional fuels, onboard carbon capture technologies would simply transfer shipboard emissions from the air and into the ground. Furthermore, apart from the variability in cost to capture CO₂, there is currently insufficient availability of CO₂ pipeline networks near ports and existing storage capacity for transporting and storing CO₂ remain limited. The competing development of clean energy alternatives could also affect demand for onboard carbon capture technologies.'

Karl Shrowder of Nautical Supply

International believed that onboard carbon capture is not gain credibility at the moment but 'it will do so once its studies have been tried and tested in harsh sailing environment' – and 'once it becomes a price competitive basis the cost of compliance carbon allowances'.

MakingSense's **Kasper Søgaard** told us that: 'There are two key questions for the long-term viability of onboard carbon capture. The first is whether it can be a cost-effective way of delivering near-zero emissions by 2050. If not then it will just become a transitional technology, which will limit its relevance. The second question is whether onboard carbon capture can be competitive with blue fuels based on point source carbon capture in the fuel production process, which to me seems unlikely.'

Idwal's **John Nicholson** also felt that more questions needed to be asked, and investments made. 'There seems to be limited news about these types of systems and capacity of vessels and where these systems are installed,' he said. 'There is also the question as to what shore side facilities there are available to receive carbon capture from vessels and how much it will cost to dispose of them.'

Do you believe that voyage optimisation technologies and Just-in-Time scheduling could have a significant role to play in helping ships to improve their energy efficiency and reduce fuel consumption?

'If one doesn't improve one's own voyages, how can we collectively optimise the whole industry?' asked **Steven Jones**. 'It seems an absolute necessity to be able to make trade flow better in order to ensure we do not "rush to wait".'

'It is through voyage optimisation technology, but more importantly the sharing capabilities of digitalisation which truly allows the reality of just-in-time to come to fruition. Voyage optimisation is one of those key pillars which is vital in delivering sustainable shipping.'

Albert Leyson assured us that: 'This type of technology has already reached maturity and just needs to be more widely adopted.'

Mark Williams judged that: 'We are on the cusp of an AI revolution in fleet optimisation, with the casino of the freight market being replaced by algorithms to ensure that there is always capacity to meet short term demand but not as much oversupply as the industry is used to.'

ZeroNorth's **Soren Meyer** was confident that: 'Advanced, integrated technologies can now help to optimise voyages both ahead of time and enable vessels to change course in real time for the good of the planet, operations, and an organisation's bottom-line. Software can connect multiple data points

across a single interface, interpreting that data to generate voyage optimisation recommendations. Technology platforms can highlight the optimal route based on specific goals for voyage, vessel, bunker and emissions optimisation. This in turn can help to reduce fuel consumption, save money and lower emissions.'

Going into more detail, Meyer explained: 'Operators can compare multiple routes, giving them transparency on weather, financial upsides, speed and CO₂ emissions. As weather is dynamic, solutions can offer data in real time with updated forecasts and notifications that alert operators if a route's optimal speed and route needs to be adjusted.'

Meyer also pointed out that: 'Integrated weather routing will only become more important as the industry transitions to cleaner fuels. Revenue upsides will allow the industry to manage the transition to more expensive, low carbon alternative fuels, as every ton of fuel saved through weather routing represents more money that the sector can invest into clean fuel adoption and energy efficiency technologies.'

Dyonisis Diamantopoulos told us: 'In Baseblue we strongly agree with the statement that voyage optimisation technologies and just-in-time scheduling could play a significant role to increase efficiency, decrease fuel consumption and subsequently emissions.'

'With our innovative software platform,' Diamantopoulos continued, 'we are providing clients with a data driven decision-making tool, that offers anything from fleet monitoring, weather forecasting, and performance/ voyage optimisation services, bunker post-fixing operations, A to Z follow up and monitoring of bunker deliveries, physical supplier vetting, fuel strategy and voyage calculators, emissions monitoring and CII and EU ETS modules. Digitalisation is here to stay, data is details, details are knowledge and knowledge is power; power to improve, become more efficient, reduce vessel downtime, optimise routing, proactively carving out strategies on fueling and eventually act in a more cost-beneficial way reducing vessel downtime, consumption, and emissions in the end.'

Smart Green Shipping's **Diane Gilpin** was also able to speak from experience, reporting that: 'Our FastRoute Optimise software is showing that FastRig wingsails, when combined with route optimisation, adds an additional 50% fuel/GHG saving.'

For NAPA's **Pekka Pakkanen**, voyage optimisation solutions are 'a "no-brainer" in enabling shipping's decarbonisation whilst also having a positive impact on companies' bottom lines.' Pakkanen continued: 'Demand for it is growing exponentially,

driven by tangible value in helping make voyages more efficient, thereby reducing fuel costs and greenhouse gas (GHG) emissions. The benefits are proven from both an environmental and commercial perspective.

‘Further, by recognising that vessels operate in complex environments with multiple considerations, where fuel performance can be impacted by a range of sea and weather conditions, but also by business imperatives, there is a strong business case for investing in these solutions. Weather routing alone can contribute to **saving an average 10%** of fuel consumption and GHG emissions.

‘But sustainability is a transition on multiple fronts; while owners and operators are often at the center of the conversation, holistic data-driven optimisation calls for collaboration from stakeholders across the value chain, from ports to cargo owners and financial institutions.

‘An example of such collaboration in practice,’ said Pakkanen, ‘is the **Blue Visby Solution**. Leveraging NAPA’s expertise in data modelling and voyage optimisation, the Blue Visby Solution is tackling the issue of “Sail Fast Then Wait” by staggering arrival times and allowing ships to slow down and reduce their emissions by 15% on average, without losing any competitive advantage. Critically, it fosters an environment of collaboration, transparency and trust between stakeholders in shipping and beyond, helping the industry embrace new practices with greater confidence.

‘Digital solutions like voyage optimisation have carved their place as a proven and measurable tool, but combining this with energy-efficiency solutions, from wind-assisted propulsion to low-carbon fuels and batteries, helps maximise emissions savings across fleets. Quantifying this, in a recent **joint study with Sumitomo Heavy Industries and Norsepower**, we confirmed that using NAPA Voyage Optimization alongside the Norsepower Rotor Sail™ has the potential to deliver up to 28% emissions reduction on average. Wind propulsion and voyage optimisation are essential pillars to decarbonising shipping and work together harmoniously to achieve better results (i.e., when the ship is routed to make the most of weather conditions).

‘These are valuable savings which can be achieved today. In fact, according to **consulting firm McKinsey**, about 80% of shipping’s decarbonisation progress this decade will come from energy efficiency measures and solutions like clean technologies and voyage optimisation, which will contribute about one-third of the savings to get us to 2050 targets. This shows the importance of making the most of existing technology to reduce greenhouse gas emissions in the short term, ena-

bling shipping to make significant progress on its decarbonisation targets in the longer term.’

Kasper Søgaard emphasised the need for collaboration. ‘The cheapest fuel is the fuel you don’t use,’ he pointed out, ‘so the business case for improving operational efficiency is very compelling although the implementation of just-in-time scheduling can be complex as it involves a lot of different stakeholders, who will need to coordinate and collaborate more. Fortunately there are a lot of interesting initiatives such as Blue Visby underway that can hopefully make it easier to do in practice.’

DNV’s **Hans Anton Tvette** also called for more pooling of resources, talent and data, saying: ‘There is definitely an opportunity to increase voyage efficiency through speed optimisation, and Just-in-Time arrival. However, in order to capitalise on these opportunities, we need to see

terminals. Such barriers are being addressed and again a lot of work has been undertaken by IMO and IAPH with the industry to investigate how such barriers can be removed.’

UNCTAD’s **Jan Hoffmann** felt that a lack of cooperation has sometimes held progress back in the past. ‘Port call optimisation has been on the cards for several years,’ he said. ‘I had expected more advances, but it seems that legal frameworks stakeholders may not always be ready to accept “notice of readiness” before the actual arrival. Also, data exchanges and collaboration among supply chain players do not work as well as they should.

‘At times, we see sincere concerns about data protection for commercial and private reasons, or valid concerns about the potential intervention of competition authorities if market players coordinate too much. At other times, I am not sure if we also see

‘The climate emergency is too urgent not to go as directly and rapidly as possible toward zero-emission solutions like green e-fuels and electrification’

Antonio Santos, Pacific Environment

increased collaboration between charterers, owners, and ports, to make it happen.

‘To enable greater cooperation and efficiency, we need to enable timely collection and sharing of accurate data, share the costs and benefits of efficiency measures more equitably between stakeholders to avoid split incentives, and standardize data sharing across ports and terminals.

‘At DNV, we recently launched a new recommended practice on technical ship performance which sets out a method to measure, evaluate and verify vessel performance accurately and transparently. This could help to alleviate some of these barriers.’

Edmund Hughes reported that IBIA is also helping to foster the necessary collaboration. ‘Voyage optimisation technologies are already commonplace and in the end they are part of the toolbox to assist decision making,’ he noted. ‘Some of the most significant barriers to JIT scheduling is the nature of commercial operation of ships and, in particular, “due dispatch” clauses in charterparties and also the commercial priorities between ports and their

that players invent pretexts for not exchanging and collaborating as much as possible.’

Raal Harris of Ocean Technologies Group believed that voyage optimisation will become increasingly attractive as the energy transition continues because: ‘All the fuels of the future look to be more expensive and prone to availability issues, so it makes good business sense to use less energy wherever and how ever we can.’

Harris continued: ‘There are undoubtedly huge gains to be had from energy efficiency measures. We need to make incremental changes across our operations and ensure that our maritime professionals at sea and ashore understand how their individual and collective contributions can make big changes for the benefit of their companies our industry and our planet.’

Adrian Tolson pointed out that we still depend on ‘the quality of the data input – such as whose bunker prices you think are more accurate – to make the best decisions’. He continued: ‘My guess is that each of these tools will soon produce the same result if given

the same data – once data is more standardised, I think we will come to accept these tools as part of normal vessel operations.'

John Nicholson felt that, even with these tools at their disposal, players still need to sharpen up their communication and planning. 'I do believe this would help in a small way to reduce emissions,' he said. 'However, I also feel that a lot of responsibility is put onto the vessel and that ports need to be held more accountable and have more responsibility for better planning and communication to vessels to allow vessels to more accurately estimate arrival times. Charterers also need to have a better understanding of the pressure the vessels and ship owners face to reduce their emissions and allow slow down and 'just in time' ETAs to happen.'

Anthony Mollet of the Marine Fuels Alliance said that: 'Ultimately, ships are running to time. An owner has an obligation to the charterer to deliver the goods or position a vessel to a specific contractual requirement. As tends to be the case in business, commercial pressures can dominate. So long as there are no safety issues, then ships will continue to steam to the next ports and to complete their obligations. We are aware already of some companies increasing speed to reach ports to tender NOR or avoid demurrage, while burning conventional fossil fuel bunkers. The irony is then, when they look to procure biofuels in that port for the next leg of the voyage!'

Intent Communications' **Namrata Nadkarni** reminded us that these technologies bring other benefits besides improving ships' efficiency and emissions profiles. 'Given the immediate benefits and low costs to implement voyage optimisation and JIT scheduling,' she said, 'I am surprised that this is not the norm in shipping already. Not only are both solutions fuel-agnostic but they have repeatedly been proven to work as well – meaning that there are guaranteed benefits to incorporating them into vessel and port operations. Furthermore, the acceleration in maritime digitalisation has strengthened the business case for using such solutions and finding staff that have the right skills for online systems to optimise vessel calls. A recent study shared by IMO's GreenVoyage2050 project showed that even in small doses, JIT delivered significant fuel and emission savings; and voyage optimisation will not only support greener shipping but also benefit the safety of seafarers who will not have to work in dangerous conditions.'

The technologies certainly drew a positive response from the climate NGOs taking part in the Survey. **Antonio Santos** commented: 'Vessel speed reduction is a proven strategy to improve energy efficiency and reduce fuel

consumption in maritime shipping (see the CE Delft study). In addition, ships can reduce the harmful impact of underwater noise on ocean life by slowing down. Also, reducing vessel speed is one of the most effective solutions to reduce vessel collisions with marine animals.'

Elissama Menezes concurred: 'Voyage optimisation and just-in-time scheduling are two effective measures that can significantly reduce fuel consumption while also benefiting people and nature as stated in the report *Navigating the Future: Bridging Shipping, Biodiversity, and Decarbonization*. Launched at COP28, this report also highlighted the co-benefits and overlaps of shipping solutions that can help address multiple global and local threats.'

Menezes outlined further environmental and societal benefits: 'By optimising voyages and scheduling them for just-in-time arrivals, the negative environmental impact and disturbance of shipping activities to nearby communities can be minimised while emissions reductions are achieved. Factors such as migration paths of marine animals and caribou in the Arctic, and Indigenous Peoples' cultural sites can be considered when optimising voyages. Furthermore, just-in-time scheduling can support a reduction in global fleet speed, leading to a substantial decrease in GHG emissions. This reduction could significantly decrease underwater noise and lower the risk of ship strikes. Additionally, just-in-time measures can reduce air pollution in port communities by minimising the waiting time of vessels. Utilising the co-benefits of energy efficiency measures for the climate, people, and nature is essential to transition from a fossil fuel-based sector to a sustainable, just, equitable, zero-emission one.'

Allyson Browne saw these technologies as a place where 'digitalisation meets decarbonisation: leveraging data, algorithms and technology to improve energy efficiency and reduce fuel consumption'. She continued: 'It's great to see the progress of green and digital shipping corridors like Rotterdam x Singapore – two ports at the helm of advancing maritime logistics and prioritising both decarbonisation and digitalisation. Voyage optimisation and JIT scheduling also come with co-benefits for port communities and marine ecosystems by reducing port congestion, minimising the time ships spend idling for a berth to become available, and promoting slow steaming – all of which reduce pollution, and slow steaming also reduces underwater noise and vessel collisions with marine wildlife.'

IWSA's **Gavin Allwright** noted: 'We are an industry that often rushes to wait, burn-ing large amounts of fuel to then have the

ship wait for days/weeks or the cargos languish in the port for lengthy periods of time. Thus, projects like Blue Visby have real potential to make a substantial change. 2030 targets are not possible without a significant roll out of these measures.'

The technology is of particular interest to IWSA, Allwright explained, because: 'Voyage optimisation is especially beneficial when it is also linked to wind propulsion deployment, and here some magic starts to work. As an example of how significant these can be, the energy derived from wind propulsion systems can be effectively doubled across the board when weather-routing for wind and speed calibrations are used. Of course, with primary wind vessels, that will be even stronger, especially on windier routes.'

The IMO's Carbon Intensity Indicator (CII) and Energy Efficiency Existing Ship Index (EEXI) regulations came into effect on 1 January 2023. Do you believe these regulations are having/ will have a significant impact on operations in the shipping industry?

'The CII regulation has a "soft start",' said CORE POWER's **Unni Einemo**, 'but once ships get rated on the A to E scale, it will make it evident which ships need to improve their score. The requirements will become stricter when the initial CII framework is revised, and force shipping companies into taking corrective measures to improve the rating of their ships if they get a 'D' rating for three years in a row, or an 'E' rating. These measures can be in the form of efficiency improvements and/or the use of low carbon fuels, so it can also be a driver for the energy transition. It is one of several concrete tools to achieve the emission reduction goals set in the IMO's GHG Strategy. More tools will come, such as a GHG fuel standard (similar to FuelEU Maritime) and probably some form of GHG pricing mechanism.'

Edmund Hughes noted that: 'Whilst there are many in the sector who see the CII as problematic, one of the outcomes of this requirement is that we have seen significant efforts between shipowners and charterers to reflect and better share the risks of compliance within charterparties. This is critical as we move into an era of carbon pricing (EU-ETS entered into effect on 1 January 2024) where those responsible for complying with the emission requirements (the 'polluter-pays' principle) will need to be more unambiguously defined.'

Albert Leyson believed: 'These regulations will set the stage for ship operators and industry shareholders alike. They will have a significant impact within the next four to five years

as market-based measures, incentivization schemes, and grading systems come into play.'

Pekka Pakkanen pointed out that we are already seeing the impact of CII. 'Over the last year alone,' Pakkanen said, 'CII has brought a paradigm shift in the way ship owners and charterers collaborate. There has been a greater willingness to make decarbonisation a commercially viable and operationally sensible priority on both sides.'

'Starting this year, companies will be receiving their first CII ratings based on 2023 data, and it is likely that these ratings will factor into decisions on their chartered fleet. We're already seeing this stimulus from across the value chain: ESG-conscious cargo owners and public sentiment are demanding more sustainable shipping, while top-rated vessels are poised to receive better freight rates, loan conditions and interest rates, or lower insurance costs.'

'This means that, if we are to make CII a success, we need collaboration from stakeholders across the value chain to monitor, assess, and share information on the vessel's performance in real time. This needs to be underpinned by concrete data to give shipowners and operators greater clarity on the impact of their operational decisions. In a step to better understand the impact and value of taking a proactive approach to CII, last year we conducted a [joint study with shipowner Marubeni](#) and classification society ClassNK to measure the impact of voyage optimisation on the greenhouse gas emissions and Carbon Intensity Indicator (CII) ratings of a real-life fleet. We found that voyage optimisation enables ships to reduce their fuel consumption and CO₂ emissions by up to 7.3%, and maintain their CII ratings for an additional two to three years.'

'The key takeaway,' said Pakkanen, 'was that regulations like CII have immense potential in enabling fuel and emissions reductions but need to be approached with the right toolkit. Data-driven solutions are critical in giving the industry the confidence they need on the performance of new systems or operational measures, to then make strategic decisions and commercial investments.'

Dyonisis Diamantopoulos gave a very detailed response: 'Both the CII and the EEXI are regulations that are affecting and will affect the maritime industry in a significant way in different aspects; one in the operational efficiency part and the other on the technical efficiency. On the one hand vessels will be labeled for a total of one year period with a grade from A to E (A being best, E being worst), in the context of CII, based on the data from the DCS (Data Collection System).

Vessels that will be graded lower arguably would be less attractive to charterers as they would imply more emissions, therefore more costs, especially if we are talking about vessels that are to call European ports (in the context of EU ETS), whereas better graded vessels will be more attractive and potentially even enjoy higher commercial remuneration. In addition, vessels that are to be found as D (for 2 consecutive years) or E, would have to proceed in providing the authorities with a clear amendment of the SEEMP (Ship Energy Efficiency Management Plan) with included corrective actions on the improvement of the CII. CII's baseline (which would be "attached" to the "C" grade) is something that becomes more and more strict as years progress, meaning that vessels that are classified now as "C" would potentially be classified as D or E in the upcoming years.'

ways for compliance would include ways to make the vessel more efficient by reducing the amount of energy needed to propel itself. Increased efficiency would translate to consumption of lower amounts of fuel and subsequent reduction of GHG emissions whilst not being forced to decrease speed and therefore vessel utilisation potential and also competitiveness. Wärtsilä argues that some solid ways to achieve that is with the installation of energy saving technologies, install of shaft generator systems, adopting hybrid systems and using alternative fuels.'

Drawing upon the Marine Fuels Alliance's industry network, **Anthony Mollet** reported that: 'From what we hear and have had discussions about, owners and operators are taking this very seriously. Shipbrokers likewise have specialists and report greater levels of questions and requests for advice from their clients.'

'Integrated weather routing will only become more important as the industry transitions to cleaner fuels'

Soren Meyer, ZeroNorth

Diamantopoulos continued: 'This whole trajectory implies that there is a high importance on controlling and reducing the consumption and subsequently emissions. Ultimately, this could force a wide number of older vessels, that are unable to comply, to hit the shores of ship recyclers. To improve CII owners have already commenced the exploration of the fueling of their vessels with alternative fuels such as biofuels as well as employing software or hardware technologies that would reduce air drag, hull drag or other measures that would translate to reduction of consumption and emissions.'

'On the other hand, the EEXI regulation, also plays a big role. It was a measure introduced by the IMO to reduce the greenhouse gas emissions of vessels and is related to the technical design of a vessel. Vessels would need to attain EEXI approval once in a lifetime by the first periodical survey in 2023 the latest. Many opted to go with power limitation meaning to drop speeds in order to comply with the EEXI requirements (some even up to 2 knots as per DNV Maritime vice president and global business director for bulk carriers Morten Løvstad). Other path-

Monjasa's **Almanda Terese Molter** didn't doubt the regulations' significance but also believed that they will need to be improved. She told us: 'Such regulations will definitely play an important role in facilitating the transition of the industry. Nonetheless, the framework for these regulations as they are right now is a one-size-fits-all, which is not sufficient in an industry consisting of many different ship types and operational models. As such, they can be addressed to capture the differences between e.g. operating on a fixed schedule vs. operating on the spot market and e.g. operating as a liner moving a lot vs. operating as a bunker supplier with less movement. Furthermore, these regulatory frameworks need a more effective "stick" component in case of non-compliance.'

Also with an eye on future revisions, **Steven Jones** said: 'CII and EEXI require strict annual carbon intensity targets, and technical efficiency requirements. These should, in theory, mean a carrot and stick approach. We can see that they are rewarding efficient ships that exceed targets while penalising those falling short with fines or operational impacts.'

'We see that, as a result, vessels are

taking steps like installing new technologies, slow steaming, and moving to new fuels. However, technical challenges, access to fuels, the costs of retrofits remain. How the regulations evolve, their enforcement and their ultimate efficacy will depend on overcoming these hurdles through further R&D, investments, incentives, standardisation, and coordinated industry action. That said, they represent a significant step.'

John Nicholson felt that: 'The rules regarding when an EPL or ShaPoLi system can be overridden are very vague and this may lead to these rules being abused by certain vessels fitted with EPLs, resulting in the power limitation being overridden often in order to meet ETAs. It is also my opinion that CII is not the best method for accurately assessing vessels' efficiency and measurements should be based on the volume/weight of cargo carried like earlier suggested methods.'

some concerns: 'The IMO's Carbon Intensity Indicator is meant to incentivise the improvement of the operational carbon intensity of the shipping sector in the short term; however, as currently implemented, it will not meaningfully reduce emissions. The CII needs to be revised and more stringent to make it more effective (the CII is set to be revised by the IMO by January 1, 2026). Among other changes, the IMO needs to ensure that emissions in the CII are reported on a well-to-wake basis and there needs to be more consequences for ships that consistently underperform. Also, allowing publication of a ship's CII score would provide more transparency in the market.'

Environmental Defense Fund's **Panos Spiliotis** and **Sofia Esquivel Elizondo** flagged up how the regulations will require industry players to work together. 'As the IMO's CII becomes more visible in 2024,' they explained, 'it will require new forms

improve the energy efficiency of ships, swiftly bringing down fuel consumption and GHG emissions while reducing spill risks, black carbon emissions, and underwater noise,' she believed. 'To achieve these goals, they must be revamped to increase ambition and cover all emissions from shipping in a life-cycle approach. This means that CII must be expanded to cover well-to-wake CO₂e and, in 2026, include an 8% per year target. By doing so, shipping efficiency regulations will be better equipped to bring the maritime sector closer to a zero-emission future while harvesting the co-benefits of efficiency measures for the environment and people.'

Opportunity Green's **Blánaid Sheeran** was also hoping for more from the IMO. 'As it stands,' she maintained, 'the IMO's CII and EEXI measures are unlikely to require significant sectoral change as the current level of ambition is set too low and the ability to enforce the measures is unclear. There is also the risk that the regulations further enable the use of fossil fuels that may offer lower carbon intensity ratings but are still highly polluting, locking the sector into the continued use of fossil fuels and diverting investment away from true zero-emission solutions and technology. It is very important that we see a more stringent energy efficiency package come into play during the next revision of the CII in 2026.'

Allyson Browne summarised all the NGOs' positions when she said: 'We need to see significant improvements to these measures in the upcoming revision process, in combination with the new basket of measures that are part of the MEPC 80 decision.'

Even though many of our respondents – especially among the NGOs – felt that the IMO's CII and EEXI would need to undergo considerable revision, there was almost unanimity with regard to their importance. **Jan Hoffmann**, however, told us: 'While the agreement on these measures is clearly a success of IMO and its member states, the final ambition agreed upon, in parallel with technological advances, leads to a situation where I have the impression that even without these new IMO instruments the energy efficiency of ships would probably have advanced almost as much.'

We'll give the final word on this subject to **Kasper Søgaard**, who concluded: 'To drive change you need to create transparency and this is what the CII does – despite its flaws. I would expect operators, customers and regulators to pay a lot of attention to the CII scores and for the regulation to be gradually strengthened and improved to drive the emissions reductions that governments have signed up to.'

'As it stands, the IMO's CII and EEXI measures are unlikely to require significant sectoral change as the current level of ambition is set too low and the ability to enforce the measures is unclear'

Blánaid Sheeran, Opportunity Green

PowerCell Group's **Victor Åkerlund** saw room for improvement. 'We encourage transparency in terms of carbon emissions and believe this is one crucial step towards polluters paying the real cost of emitting CO₂,' he said. 'However, we fear that the regulations might currently be too weak to have a significant decarbonisation effect on the industry since compliance with CII can be achieved through measures unrelated to the propulsion system.'

Mark Williams judged that the regulations 'will accelerate depreciation of older ships but this could be offset by a shortage of ships if shipyards cannot build enough alternative fuel vessels to meet future demand'. He added: 'The tech to meet the EEXI is out there, as proved by owners like Ardmore; it has to be retrofitted and that will maintain the trading life of more modern ships. A two-tier freight market may develop – but we always say that when new tech / regs come in, e.g. the single hull phase out. Eventually the market reverts to the older cheaper ships setting the rate.'

Pacific Environment's **Antonio Santos** had

of collaboration between ship owners, charterers and port operators. For example, port waiting time has an impact on a ship's A-E label. It is precisely through these new paradigms that CII may have the most significant effects on the industry.

'EDF is highly supportive of IMO's short-term measures, adopted in 2021 to guide shipping's short-term decarbonisation trajectory and start reducing shipping emissions. CII is a modern and flexible measure that allows each ship to improve its climate performance through the means appropriate to its own profile, age and commercial strategy. The latest industry data points to slowing average speeds in many cargo ships and it is likely that primarily CII but also the EEXI are playing a role. In the years to follow, a strengthened and improved post-2025 CII could have even more significant effects by accelerating shipping's energy efficiency.'

Say No to LNG's **Elissama Menezes** was looking for major changes ahead. 'There is enormous potential for revamping the CII to



Getting to zero

How can the shipping industry harness the power of wind, electricity, fuel cells and nuclear energy?

Alongside the transition to new fuels, the shipping industry is also exploring the possibilities of alternative propulsion technologies. Shipping companies are looking anew at wind, electric vessels are already on the water, and fuel cells and nuclear power are also becoming a part of the picture.

Do you think we saw significant progress on wind propulsion technologies in 2023?

The International Windship Association's **Gavin Allwright** set the scene and gave us an overview of what to expect from wind over the next few years.

'2023 was a foundational year for wind propulsion,' Allwright began. 'This can be broken down into three main categories: market movement, policy and preparation.'

'From a market perspective, we saw things building on the progress made in 2022. We predicted early last year that there would be roughly a doubling of tonnage and ship numbers outfitted with wind propulsion but added that this would be delivered with a bit of leeway due to the real challenges around the logistics crisis in 2022/early 2023.'

'We now have 32 large ships with wind assist technologies being used and another

11 are "wind-ready", of which 4-5 will receive their rigs in the next few months along with another 12-16 for delivery in early 2024. So, with the leeway taken into account, that roughly doubles the number of ships from 23 to 46+ in the next few months. This number includes three or possibly four primary wind ships. From a tonnage perspective, we have just about topped 2 million DWT, and quite a number of the new projects being installed are larger bulkers and tankers. Announcements of contracts and deals in the pipeline are also moving from single demonstrator vessels to small fleet orders and we are seeing interest growing in the container sector too, with design announcements and the first 1,000 TEU+ feeder vessel to be outfitted with containerised systems to be outfitted in the next couple of weeks. We expect the roughly doubling of installations to continue in 2024/25 and the pipeline is strengthening there too.

'Policy has also seen solid development,' Allwright reported, 'with wind propulsion being increasingly recognised as a serious part of the energy mix and an important tool required to reach the IMO and EU decarbonisation goals. Wind is being included in decarbonisation pathways and the language and integration of zero-emission "tech-

nologies" and "energy sources" alongside the traditional "fuel" component is a visible indication of this change. There has also been a lot of work underway in developing standards for validating performance, seatrial procedures, safety aspects and training, and this work will be bearing fruit in the coming months.'

'I add preparation to the list,' Allwright explained, 'as the investment, scaling and relocation of production lines for the delivery of larger numbers of wind propulsion systems has been an important development among the first wave of providers that have already entered the market. We have seen hundreds of millions being invested in these production lines and production agreements that have lifted capacity from the bespoke installation capacity of the tens of units per year in 2021/22 up to the high hundreds at least by the beginning of this year. Shipyards are also increasingly adding wind propulsion systems to their standard equipment lists and the understanding/learning curve surrounding installations has been growing this year.'

Wrapping things up, Allwright was pleased to report: 'A lot of progress and we see this very much as a foundational year in preparation for the take-off period of 2024-26.'

Norsepower's **Jukka Kuuskoski** saw 2023

as a year of progress, partnerships and performance – and was looking forward to seeing all of this generating practical solutions for fleet-wide adoption over the coming years. He began by referencing the IWSA's prediction that the industry is positioned for significantly more installations of wind propulsion solutions in early 2024 and told us: 'From Norsepower's perspective, the use of our Norsepower Rotor Sail™ has become an obvious choice for well-known maritime companies and cargo owners such as TotalEnergies, MOL, Vale and IINO Lines due to the proven environ-

mental benefits combined with reduced fuel consumption. This will only increase as more expensive alternative fuels come on-stream, especially as our solution is fuel agnostic. 'Looking more broadly at the drivers behind rising demand,' Kuuskoski continued, 'the progress made in 2023 has been driven by the need to prepare for the scale of change shipping will see in 2024 and beyond. With the European Union's Emissions Trading System (EU ETS) and the International Maritime Organization's first Carbon Industry Index (CII) ratings introduced this year, and FuelEU Maritime in 2025, ship owners and operators have increasingly been looking for scalable, proven and commercial solutions to enable them to comply with regulations and minimise emissions. 'As regulatory pressure tightens, the industry needs immediate solutions, and the answer is blowing in the wind – literally. Interest is turning into installations – at least from our perspective – and it's also important now that the conversation is shifting. It's no longer a question of "why" customers should use our system, but more about "how" our performance compares to other options. Accurate like-for-like comparisons are

'With the performance data to hand, the business case for using wind propulsion is getting stronger by the day'

Jukka Kuuskoski, Norsepower

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'Looking more broadly at the drivers behind rising demand,' Kuuskoski continued, 'the progress made in 2023 has been driven by the need to prepare for the scale of change shipping will see in 2024 and beyond. With the European Union's Emissions Trading System (EU ETS) and the International Maritime Organization's first Carbon Industry Index (CII) ratings introduced this year, and FuelEU Maritime in 2025, ship owners and operators have increasingly been looking for scalable, proven and commercial solutions to enable them to comply with regulations and minimise emissions.

'As regulatory pressure tightens, the industry needs immediate solutions, and the answer is blowing in the wind – literally. Interest is turning into installations – at least from our perspective – and it's also important now that the conversation is shifting. It's no longer a question of "why" customers should use our system, but more about "how" our performance compares to other options. Accurate like-for-like comparisons are

difficult to make due to each fleet's unique nuances, such as route, size, cargo, and frequency, but we actively encourage dialogue around proof of performance as it is crucial that providers have the credentials to back up their performance and safety claims. And, due to our experience, we can provide customers with data on our Norsepower Rotor Sail, which already has over 310,000 operating hours and has reduced more than 20,100 tons of CO₂ emissions; most other providers can't offer this reassurance. '2023 was also a year that saw the power of

partnerships,' Kuuskoski reported. 'By recognising the tangible impact of combining energy efficiency solutions, we collaborated with NAPA and Sumitomo Heavy Industries (SHI) to quantify the fuel and emissions savings potential of installing our Norsepower Rotor Sail on a tanker built by SHI and using voyage optimisation solutions. Using digital technology and sophisticated sea-state modelling, our teams demonstrated emissions reductions of 28% sailing across the Atlantic, giving ship owners and operators greater confidence in the savings potential available to them.'

Kuuskoski also gave us an update on some new initiatives. 'With the performance data to hand, the business case for using wind propulsion is getting stronger by the day, but at the same time, we are also passionate about tearing down the barriers to accessing these solutions,' he said. 'That's why, in late 2023, we announced our collaboration with IINO Lines and Mizuho Leasing to launch an innovative new leasing initiative for our Norsepower Rotor Sail. This partnership addresses the typical upfront capital requirements and makes it easier and faster for companies

to adopt our product and reduce fuel consumption and greenhouse gas (GHG) emissions. This new service was driven by the recognition that GHG and other emissions reductions with low carbon or green fuels alone before 2030 will be minimal, which is why investing in energy efficiency solutions earlier will maximise savings and help future-proof operations in the long run.'

Concluding his remarks, Kuuskoski said: '2023 accelerated the drive to bring sails back to shipping. It catalysed a shift in recognition that wind is an inexhaustible, free and carbon-neutral energy source – a "no-brainer" to help save fuel and the planet. To make an impact, 2024 must be the year that we put the practical measures in place to roll out the use of wind propulsion on a fleet-wide basis.'

Another well-known proponent of the wind propulsion sector, Smart Green Shipping's **Diane Gilpin** was also confident for 2024, and keen to stress the importance of working together. 'As a developer of FastRig wing-sails I can confirm we saw considerable uplift in market interest in our product and services,' she reported. 'There is genuine understanding of the techno-economic benefits of wind. There are still barriers to adoption but by working collaboratively with ship owners and operators we are overcoming operational concerns.'

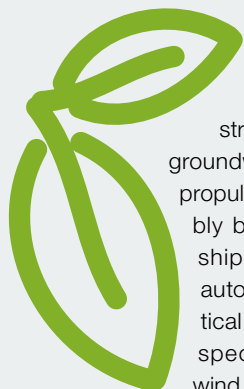
'Speaking from our own design and engineering experience,' said Houlder's **Sean McLaughlin**, 'we've seen progress with wind propulsion and wind assistance technologies. In 2023, we participated in the "Winds of Change" project led by Smart Green Shipping (SGS). The project sees an SGS FastRig wing sail retrofitted to a large commercial vessel. Our role has spanned engineering system integration and vessel performance monitoring.

'We are developing new tools that will help assess "wind assist" and other new technologies and initiatives such as this, coupled with performance monitoring – an essential part of moving wind assist and other essential decarbonisation technologies forward. Clear data on the specific fuel and emissions savings of green solutions can help build the commercial case required for final investment decisions. This will help with the essential pull through of new technologies in shipping. It cannot be left for technology providers to produce the solutions in a vacuum. Fundamentally, each ship has different efficiency requirements and will benefit from different technology blends.'

In addition to these positive reports from some of the principal players, the classification societies offered some third-party verification of wind propulsion's current status.

Nick Brown of Bureau Veritas consid-





ered that: 'In 2023, the maritime industry made significant strides in establishing the groundwork for wind assisted propulsion, showcased notably by the *Canopée* cargo ship. Equipped with four automated articulated vertical wing sails, this vessel, specifically designed for wind propulsion, set a precedent, proving the viability of such systems on merchant ships. Bureau Veritas (BV) Rules played a pivotal role in guiding the integration process, ensuring a comprehensive evaluation of stability, structural integration, and weight compatibility.'

'Crucially, retrofit projects, exemplified by the collaboration with Louis Dreyfus Armateurs on the *Ville de Bordeaux*, demonstrated the practicality of retrofitting for existing vessels. This realisation expands the pool of eligible vessels, providing a pragmatic solution for integrating wind propulsion technologies into existing fleets.'

'Collaborative initiatives like the Joint Industry Project WiSP and the NORVENT project underscored a collective commitment to knowledge-sharing, best practices, and harmonising evaluations for wind propulsion systems. These efforts marked a significant step towards more transparent performance prediction, which is essential to instil confidence among shipowners to embrace and integrate wind propulsion technologies.'

'With the groundwork laid in 2023,' Brown concluded, 'wind propulsion technologies are predicted to take flight in 2024.'

DNV's **Hasso Hoffmeister** told us: 'For wind assisted technologies, 2023 was a year that saw some very significant projects enter into commercial operation. The wide range was also striking- from wings, or rotors, to inflatable sails – there were a wide variety of systems deployed.'

'To pick one example, I think the DNV classed *Berge Olympus* was a real step up in terms of the size of the installation. Its 4 sails and 3,000 square metre sail area generate as much power as one of the largest sailing vessels ever built – the *Preussen*. Once we see the results from the operation of the vessel and how this impacts the pay-back time this could be another boost to this technology.'

'From DNV's side – having worked on many wind projects – one of the big take-aways was the interest we are getting not just from vessel operators and owners, but from many different stakeholders, including financiers. Wind has taken a big step for-

ward in terms of getting onto shipping's radar and I am sure we can build on that in 2024.'

Meanwhile, DNV's **Johanna Tranell**, said: 'I think it is fair to say that 2023 continued the momentum that built up over 2022 and even increased further. Furthermore, there is a large increase of installations in the orderbook, which clearly indicates that there are many stakeholders who believe in WAPS as a solution to decarbonize the fleet.'

'At DNV, we continue to support these developments before, during and after installation by improving technical standards and offering new services. With more installed WAPS systems, 2024 will be a very exciting year, in terms of verifying and optimising the technology in operation to further exploit the benefits and broaden uptake.'

While many respondents saw a steady build-up in support for wind, Intent

perhaps a bit of a no brainer. The wind doth blow. We have always known that,' he said. 'Now comes the trickier bit. Harnessing it and making it a propulsive force for good.'

'Seeing so many vessels now fitted with the latest technology to deliver on these promises would suggest that we are making progress. However, it seems like the data still needs to really outline the deliverables.'

'From a purity of concept, wind wins. From an operational reality there are of course complications to be dealt with and managed. We need to know that seafarers are trained and can use them. What are the impacts on safety of navigation, etc. We need to know that ports are able to accept them, that marine pilots are willing to bring them alongside. Then so too the small matters of legal, construction, safety compliance, and marine insurance implications.'

'Port-wide electrification presents a major opportunity for ports to accelerate decarbonisation across their operations and reduce their Scope 1-3 emissions, including drayage, cargo-handling equipment, harbour craft and OGVs'

Allyson Browne, HACC

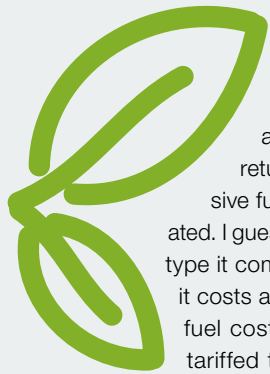
Communications' **Namrata Nadkarni** had a slightly different perspective, although the upshot – more progress over the coming years – was the same. 'Wind power gained a lot of traction in 2023, which is in stark contrast to the year before,' she said. 'Data from the annual ICS Maritime Barometer report shows that in 2021-22 most respondents didn't see wind power as a viable solution even in the long term. The most recent survey (2022-2023) had respondents looking at wind as an option not only in the long term but also the medium term, which is a real change in attitude. We also saw a number of installations on vessels and companies such as Yara Marine Technologies, Smart Green Shipping and bound4blue have all made big announcements about installations onboard vessels, which means that the market is truly embracing this (legitimately) future-proof technology.'

Steven Jones of the Sustainable Shipping Initiative was another who felt that the science was clear, but we still need to work out practicalities. 'Wind propulsion and assistance is

'So, we need more data, more answers and commitments from up and down the value chain. The sails need more than sales spiel, they need to do more than just suggest viability. When that is done, then it would indeed seem that wind propulsion is indeed the power to move ships with the only downside being the vagaries of weather.'

There were some issues raised by our Survey respondents. **Karl Shrowder** of Nautical Supply International said that 'you will likely lose cargo space when installing these devices, whether it be by weight or volume', and there could be logistical constraints when entering some ports with a huge sail(s) fitted.

Idwal's **John Nicholson** pointed out that: 'Consideration should be given to the GHG emissions needed to manufacture and install these pieces of equipment vs the returns they provide once installed, similar to the "well-to-wake" theory for fuels. I don't believe these systems will offer substantial returns in regard to reducing emissions. Maintenance and repair costs must also be factored in.'



Adrian Tolson of 2050 Marine Energy cautioned: 'There is a law of diminishing returns and stories of massive fuel savings are exaggerated. I guess like all solutions of this type it comes down to how much it costs and therefore how much fuel cost it saves. If fossil gets tarified to death and becomes super expensive this makes even the smallest fuel savings significant. But if the cost of lower GHG fuels generally falls to meet the cost of fossil then these "expensive" modifications might be just too expensive.'

Wind propulsion generated a strong show of approval from the NGOs taking part in the survey. Pacific Environment's **Antonio Santos** believed that: 'Meaningful progress continues to be made on wind-assistance technologies for maritime shipping as the number of ships that have installed or are planning to install these systems are increasing. Wind-assistance technologies have already been identified as a key strategy for shipping companies to help them achieve the IMO's GHG reduction target for 2030.'

'A June 2023 study by CE Delft showed that the global shipping industry could reduce GHG emissions by nearly 50% by the end of this decade by deploying 5-10% zero or near-zero emission fuels, using wind-assistance technologies, and by implementing vessel speed reduction. In addition, the 2023 IMO GHG Strategy indicates a goal for "uptake of zero or near-zero GHG emission technologies, fuels and/or energy sources to represent at least 5%, striving for 10%, of the energy used by international shipping by 2030," which should further incentivise the uptake of wind-assistance technologies in the near term.'

Sofia Esquivel Elizondo and **Panos Spiliotis** of Environmental Defense Fund saw wind-assisted propulsion as 'an exciting bet for smart ship owners and the best way for modern ships to directly harness clean renewable power'. They continued: 'At the end of 2023, the global fleet included more than 30 ocean going ships equipped with the technology, with a gradual progress in new orders and deliveries in the past year. While bunker prices remain relatively stable, the commercial incentive may not be fully in place for the technology to reach scale in the existing fleet. European Union's Fuel EU regulation will offer ships compliance credit for wind-assist systems and some incentivisation could be part of the IMO's Basket of Measures, including the Carbon Intensity Indicator. For the industry to meet IMO's new 2030 climate checkpoints, we

will need to see a faster uptake and operation of all versions of wind-assisted propulsion.'

Say No to LNG's **Elissama Menezes** pointed out that while wind propulsion technologies are 'gaining more attention in the shipping industry's decarbonisation efforts', more support is still needed to 'scale them up and take advantage of all their benefits'.

Allyson Browne of HACC was very positive about the technology – but she was keen to see wind propulsion provide support for, rather than a distraction from, the shift to alternative fuels. 'There's been notable advancement in wind propulsion technologies, with several new projects and prototypes being tested and showing promise for supplemental energy sources for ships,' she said. 'But we need to see these technologies deployed on vessels designed and purpose-built as windships powered by clean fuels – not just add wind tech to reduce consumption of traditional fuels and allow for the continued reliance on fossil fueled ships.'

Did we see significant progress on maritime electrification (in terms of both battery-powered propulsion and shore power technology) in 2023?

Robert Schluter of e1 Marine said that: '2023 saw the right signals from regulators being sent to the industry to make maritime electrification a tangible reality. In shoreside power in particular, the California Air Resources Board's new compliance requirements for the At Berth Regulation while the European Commission's plans "to regulate access of the most polluting ships to EU ports and to oblige docked ships to use shoreside electricity" as plans for the EU Emissions Trading Scheme formalise within its Green Deal is offering a clear pathway. And these signals are being followed up with much-needed investment, such as \$653 million allocated towards 41 port improvement projects by the US Department of Transportation's Maritime Administration (MARAD).'

'However,' Schluter continued, 'it has become very apparent that ensuring a reliable power supply will be challenging for many ports in 2024 and beyond. The costs associated with electric-powered vessels are high compared to untaxed heavy fuel oil, and there is uncertainty around its availability to satisfy maritime power demands when ports share a local grid with neighbouring communities. While it's great to see new vessels on the water today featuring battery-powered propulsion, there is still much-needed progress to scale maritime electrification to meet ambitious regulatory targets.'

'As an industry, we've been hearing for

some time how the first and last mile is critical to decarbonise. However, from our conversations with many small vessel operators and ports, there is still a lot of uncertainty about the progress and viability of maritime electrification beyond the top 1% of ports. We're hoping that 2024 will be the year that we turn a corner and progress towards making maritime electrification a reality for the entire industry.'

'I think we can say progress was steady,' considered DNV's **Narve Mjos**. 'Year on year we are building the number of vessels hitting the water – up to 873 in 2023 with a further 188 on order. In Norway we have had fantastic development in terms of battery electrification – led by the ferry sector. Over the next few years development will continue, but most likely at a slower pace as many of the low hanging fruits are taken.'

'One of the big standouts of 2023, which really shows where the segment is at, is the DNV-classed Buquebus ferry, currently under construction at Incat. This 130-metre ship will have a battery capacity of over 40 MWh, almost four times the capacity of any battery-powered vessel constructed before. When it launches this will be a record breaker – for the largest battery storage, longest route, highest speed, and most powerful on-shore charging solution. In particular it will highlight new high density batteries from Corvus which is really important if we want to extend range without adding excess weight. Something to look forward to in 2024!'

Houlder's **Sean McLaughlin** also noted the growing momentum: 'There are ever more examples of battery and hybrid vessels in use today. At Houlder, we have been the technical partner on the *Manxman* – the Isle of Man Steam Packet Company's new battery hybrid ferry. This is not a concept or specialist vessel either; it is an example of battery hybrid becoming a norm for fixed route short-sea shipping.'

'The cruise industry has made headlines for its in-port emissions too. The problem, which has been widely recognised in UK ports for about five years and is not unique to cruise ships, is getting sufficient shore power to the ports and then onto the ships. This is also one of the biggest barriers to full vessel electrification. The on-board technology is available and there are ship owners who are prepared to consider investment in full electrification but the barrier is the shore-side infrastructure to power the vessels.'

'We are increasingly working on power barge projects which seek to address challenges in taking power to remote areas and replace high emission diesel generators. There is potential for power barges to provide limited and short term solutions for some

vessel electrification, but for full electrification to provide a realistic large scale opportunity to deliver a decarbonisation solution to shipping its essential that there is a supply of low or zero carbon electricity from the grid.'

Antonio Santos gave us a run-down of developments in the various global regions. 'In the US,' he began, 'there has been significant progress on electrification for ferries,

European countries have also been leading the charge on electric ferries, thanks in part to robust government support.'

Santos then turned his attention to shore power technology, and told us: 'As of 2022, the US Environmental Protection Agency (EPA) reported that 10 US ports had installed high- or medium-voltage shore-power systems capable of powering cruise, container,

that: 'In October 2023, the EPA approved the CARB waiver request for California's amended At Berth ocean-going vessel regulations, which expand the state's requirement for vessels to plug into shore power to more California ports and more vessel types.

'For 2024,' Browne believed, 'port-wide electrification presents a major opportunity for ports to accelerate decarbonisation across their operations and reduce their Scope 1-3 emissions, including drayage, cargo-handling equipment, harbour craft and OGVs. Electrification and renewable energy can be coupled to transform ports into clean energy hubs.'

Many of our respondents – and probably our readers too – would agree with Browne about electrification and battery power becoming more viable for ferries and short sea shipping, but still have questions about the technology's usage on the biggest ships in the global fleet.

For Shipping Strategy's **Mark Williams**: 'Batteries are still constrained; the power output is not big enough for most ocean-going vessels. Sodium ion batteries offer some electricity storage options but again not powerful enough to provide propulsion energy.' On the issue of onshore power supply (OPS), however, Williams believed that: 'Renewable shore power and cold ironing area increasingly popular and here to stay.'

While battery-powered mega container-ships may not be appearing on the horizon just yet, there was a general consensus that electric propulsion is making real progress in those specialised short sea and ferry sectors. IBIA's **Edmund Hughes** judged that: 'For short sea shipping electric/hybrid ships are becoming a readily available option for those considering the propulsion for a new ship. However, it is likely to be local regulatory requirements that will be the most significant driver for their adoption.'

Baseblue's **Dyonisis Diamantopoulos** concurred: 'Electrification is a great solution for the ferry and parts of the short sea segment. In addition, we see an increased number of OPS installations, not least due to the requirement of OPS usage laid out in the FuelEU Maritime regulation making OPS mandatory for liners and passenger vessels in the years to come.'

The impact of FuelEU Maritime was a point picked up by MakingSense's **Kasper Søgaard** too, who noted: 'The adoption of FuelEU Maritime in 2023 means that shore power will become mandatory in European ports, which will drive its uptake at least regionally.'

John Nicholson highlighted FuelEU Maritime mandating the use of shore power as well, and he noted that there will be assistance provided to ports to facilitate the installation

'Nuclear provides an incredibly energy-dense and reliable source of power, which is released without combustion, meaning nuclear reactors operate without any emissions to the air: no greenhouse gases, no noxious fumes, no particulate matter'

Unni Einemo, CORE POWER

inland cargo vessels, and short-sea shipping. Electric ferries have become more common, especially in areas with short-distance routes. These vessels are well-suited for electrification due to predictable routes and the availability of charging infrastructure. There are existing federal government programs that provide funding for projects that support the purchase of zero-emission ferries and supporting infrastructure, such as the U.S. FTA's Electric or Low-Emitting Ferry Pilot Program and Passenger Ferry Grant Program. The California's Air Resources Board (CARB) approved an update to their Commercial Harbor Craft rule in 2022 that requires certain types of harbor craft to use cleaner engines and newer technology, and all short-run ferries operated near California's coast will be fully zero-emission by the end of 2025.

'Outside of the US,' Santos continued, 'Singapore's Maritime and Port Authority has finalised a rule that requires all new harbour craft operating in the Port of Singapore after 2030 to be fully electric, be capable of using B100 biofuel, or be compatible with net-zero fuels such as hydrogen.

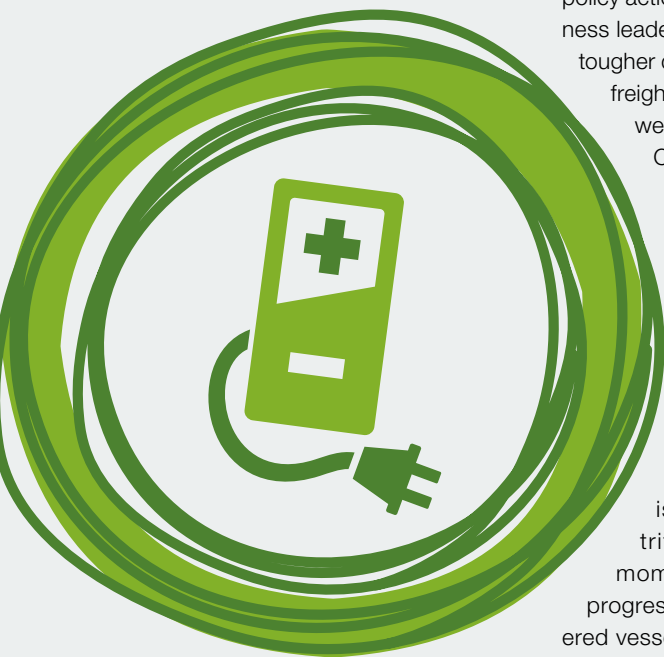
or refrigerated vessels. The continued build-out of shore power at ports across the U.S. will require significant investments in landside infrastructure. Increased public funding, such as through EPA's Clean Ports Program and MARAD's Port Infrastructure Development Program, will be critical for the development of these infrastructure upgrades.

'In addition, regulatory policies are key to driving the expansion of shore power technology. Under the European Union's FuelEU Maritime regulation, container vessels, cruise ships, and ferries need to turn off their auxiliary engines and connect to shore-side electricity from 2030 onwards when they visit European ports. In the U.S., CARB's At-Berth regulation continues to facilitate the roll-out of shore power at ports in California by including more vessel types and visits in the programme over time. And, in Congress, the Clean Shipping

Act of 2023 includes a provision that directs EPA to set requirements to eliminate in-port ship emissions by 2030 (all ships at-berth or at-anchor in U.S. ports would emit zero GHG emissions and zero air pollutant emissions) if enacted.'

Allyson Browne said that: '2023 was a big year for electrification in short-sea shipping and ferries' and she, like Santos, also picked out initiatives in California, noting





of equipment. 'We have also seen companies such as Maersk Supply Service introduce charging of batteries whilst moored to buoys,' Nicholson said. 'However, battery power for larger vessels is challenging and I believe technology with battery power on board will be limited to smaller coastals and offshore vessel. However, I believe shore power will be much more commonplace throughout the shipping industry by 2030 and onwards.'

Elissama Menezes was enthused by the prospect of maritime electrification but maintained that: 'Much more needs to be done [by decision makers and investors] if we are serious about advancing sustainable battery-powered and shore power technology.' In support of her argument, Menezes referenced a report by Oceans North which showed the potential benefits of using battery-electric propulsion for the lobster fishing fleet in Nova Scotia, Canada. 'The report suggests that over 2,000 boats could switch to battery-electric propulsion using 400 kWh batteries, which will help in eliminating 40% of fleet emissions,' said Menezes. 'Although the upfront costs for electric boats are higher than diesel boats currently, the cost break-even point for fishers (conservative estimate without incentives) is about 11 years due to much lower operating and maintenance costs. The report also highlights the need for government support, which includes setting Paris-aligned emissions reduction targets, feasibility studies, and de-risking funding.'

PowerCell Group's **Victor Åkerlund** also called for more commitment and investment. 'To accelerate further in the years to come,' he said, 'we encourage stronger

policy action, increased ambitions from business leaders within the shipping sector, and tougher demands for decarbonisation from freight buyers. One positive example we were glad to see is the First Movers Coalition, a global coalition of companies leveraging their purchasing power to decarbonise the world's heavy-emitting sectors.'

We will give the last word on this topic to **Steven Jones**, who told us: 'There has been progress, but it does not necessarily feel always like the right or significant enough progress. 'There are, though, promising signs that maritime electrification is beginning to gain momentum and making important progress, both in terms of battery-powered vessels and shore power technology. 'On the vessels side, progress has tended to be smaller in scope and scale. One must think of the likes of pilot vessels and launches of all-electric and hybrid-electric ferries, and tugs. Understandably given the technical constraints and realities, it is short-sea e-vessels which are proliferating.'

'For the ocean-going deep sea market,' Jones continued, 'electrification is more challenging, but hybrid models using batteries for port operations are emerging, along with plans for trialing all-electric autonomous ships on coastal routes. Indeed, companies are bringing new battery-powered ship technologies to market, and major shipbuilders have electric vessels on order. The pace is accelerating, driven by falling battery costs and emission regulations.'

'Onshore too there are signs of change and progress. The uptake of cold-ironing/shore power is growing – especially in certain sectors, allowing docked ships to tap port grid electricity. Though take up is still not all it should, perhaps, be. 'However, there is still a need for growing incentives, charging infrastructure buildouts – though ever stricter emissions regulations are driving adaptation and adoption.'

Do you expect to see further progress being made on the development of fuel cell technology for ships in 2024?

DNV Maritime's **Eirik Ovrud** expected that: 'Within the next few years we will see results from onboard tests of fuel cells, with real life performance measured against combustion engines. I hope for a definitive answer showing that fuel cells have significantly higher efficiency than combustion engines in real world applications. If that is shown, it will

lead to a scaling up of production with future decreases in price for fuel cells and reduced emissions from shipping, and reduced need for expensive carbon-neutral fuels.'

Kasper Søgaard was also positive about future developments: 'Fuel cell technology is very interesting in the medium to long-term and this should drive continued development of the technology.'

Dyonisis Diamantopoulos said: Alternative technologies such as fuel cell technologies are in constant development throughout all industries. It is only reasonable to consider that there will be a continued R&D and as a result of this, new outcomes and opportunities in the years to come in this aspect.'

Mark Williams had great expectations of fuel cells 'not just for ships but for all kinds of applications'. He predicted: 'Fuel cell capacity will grow. Eventually we could see up to 20k GT ships powered by fuel cells but only 2k GT size realistically at the moment.'

John Nicholson agreed that fuel cells will first appear on the smaller vessel, telling us: 'I believe this will be mainly aimed at coastal and offshore sector rather than larger commercial vessels.'

IBIA's **Alexander Prokopakis** believed that fuel cell technology for ships is a 'viable research' project, while his colleague **Edmund Hughes** judged that: 'As a technology fuel cells provide a possible credible solution to meet emission targets for certain sectors of the industry e.g., cruise passenger ships, they are likely to continue to be investigated and improvements made.'

Steven Jones was cautiously optimistic – and had some concerns. 'I do expect further progress on fuel cell technology development,' he said. 'Indeed, more ships are already being designed and built with fuel cell systems for auxiliary power, including recent orders for ferries, cruise ships, and navy vessels featuring fuel cell technology. This demonstrates increased commercial viability.'

'Leading fuel cell manufacturers are optimising their fuel cell stacks for marine applications and partnering with shipbuilders for pilots and trials. This shows growing sector-specific innovation. Major industry players are investing in R&D and participating in fuel cell testing programmes. Their involvement points to scalability potential. Meanwhile, regulations are spurring demand as a complement to batteries and sustainable fuels. This creates regulatory incentives.'

'With commercial viability, innovation, scalability and regulatory drivers, it seems there is a path forward.' However, Jones added: 'The single biggest sticking point remains though, and that is the troubling

issue of green hydrogen fuel availability. While this remains a challenge, the future of fuel cell technology is in the balance.'

Many in the industry might see fuel cell technology as a medium or long-term option, but some are hoping to up the pace significantly.

Robert Schluter of e1 Marine obviously has first-hand experience here, and he assured us: 'Today, fuel cells are already making an impact, with another hard-to-abate sector leading the charge: heavy-duty transport. As the technology is now proven on land, we're now seeing fuel cells also being integrated into marine vessels ranging from auxiliary and main propulsion, with milestones achieved in 2023. However, in addition to the maritime industry's need for larger-scale fuel cells in the future to reach the MW scale, this doesn't completely circumnavigate the challenges associated with other alternative fuels.'

But Schluter pointed out that: 'Fuel cells are only a viable decarbonisation route if there is access to alternative fuels such as green hydrogen, which is a promising candidate for fuelling shipping decarbonisation. However, green hydrogen comes with unique storage and transportation challenges, which pose significant economic, technical, logistical, and range hurdles to introducing hydrogen and fuel cell power technology to their fleet.'

'We, therefore, need to solve this hydrogen challenge and that's e1 Marine's primary focus. Our methanol to hydrogen generator products are simple, robust, and cost-effective and produce pure fuel cell grade hydrogen anywhere you need it, in real-time, as required by the marine fuel cell power solution.'

'Yet, in our journey to bring e1 Marine's methanol to hydrogen generator to market, we have experienced several hurdles in delivering this much-needed alternative fuel. This includes a lack of unified regulation, existing standards and certification and addressing customers' risk appetite to trial new technologies. We are working tirelessly to overcome these and set new standards and benchmarks for creating hydrogen on-demand, and in new, unconventional locations such as onboard vessels and within ports. By doing so, we can provide flexible, affordable, renewable power that meets environmental and operational expectations for fuel cells or even propulsion itself to enable a smarter, cleaner maritime industry.'

PowerCell Group's **Victor Åkerlund** was pleased to announce that 'a new generation of technology is ready' – exemplified by Torgshatten Nord's new Norwegian ferries that will be using hydrogen fuel cells from PowerCell. 'We see an accelerating interest from marine stakeholders who are interested in our fuel cell solutions,' Åkerlund reported.

'We also see that the pathway to decarbonised shipping through fuel cells will be different depending on type of ship and application. Some will prefer pure hydrogen, others reformed methanol and yet others reformed ammonia. PowerCell is offering, and continuously improving our leading technology for all three pathways. There is a new generation of fuel-agnostic, powerful, and ocean-ready cells here to tackle maritime emissions.'

Fuel cell technology was seen as a key part of maritime's energy transition by some of the NGOs taking part in this Survey. **Antonio Santos** of Pacific Environment believed that: 'We can only reach our goal of zero-emission shipping with fuels and energy sources that are zero-emission from well to wake. The roll-out of zero-emission technologies like fuel cells is key to zeroing out both GHG emissions and air pollutant emissions from ocean-going vessels. As the IMO, European Union, and other countries move forward with implementing strong emission regulations for commercial ships, they will push the shipping industry to explore cleaner propulsion technologies, which in turn will contribute to the development and commercialisation of fuel cells.'

Like Steven Jones, Santos focused on the available if green hydrogen, and emphasised that: 'The development of hydrogen infrastructure in the US is crucial for the widespread adoption of fuel cell technology.' There has been some good news on this front, as Santos reported: 'In October 2023, the Biden administration announced the launch of seven regional hydrogen hubs across the country to accelerate the commercial-scale deployment of clean hydrogen.'

Opportunity Green's **Nuala Doyle** judged that: 'Fuel cell technology will have an important role as an alternative to the fossil fuels used today, particularly for fixed routes covering shorter distances. It's therefore important that we see further progress made in developing fuel cell technology over the next year, both from a research and development, and regulatory perspective. We've already seen exciting developments from companies such as Future Proof Shipping, and we expect to see further progress in the coming year. Taking a whole systems approach, it is also important that we see regulations put in place to drive the supply of green hydrogen for the shipping sector, to ensure that the progress made in developing fuel cell technologies is met with a secure supply of green hydrogen to power these vessels.'

We'll close this section with some guidance from High Ambition Climate Collective's **Allyson Browne**, who described 'green-hydrogen fuel cell ships' as 'the north star

for shipping decarbonisation' and warned: 'Unless we quickly find a way to propel a cargo ship on wind-power alone, or solve battery-tech's weight problem, this is the technology we need to be optimising for in research and development, investment and pilot projects.'

Do you expect to see further progress being made on the development of nuclear power for ships over the next decade?

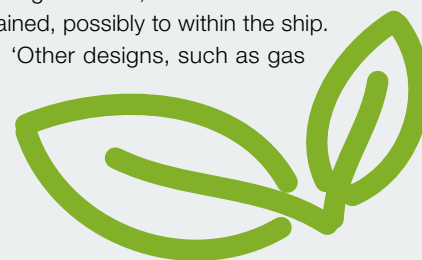
We will begin our round-up with **Unni Einemo**, who works for one of the companies – CORE POWER – that will be looking to be in the vanguard of this effort. 'The next decade will be very exciting, and I expect important progress in this area,' she enthused. 'Nuclear provides an incredibly energy-dense and reliable source of power, which is released without combustion, meaning nuclear reactors operate without any emissions to the air: no greenhouse gases, no noxious fumes, no particulate matter. And they are quiet. That ticks all the boxes for environmentally friendly ships. When you add the ability to operate at speed, and continuous operation for years without needing to refuel, it's a winner!'

'Nuclear reactors have been used to power ships since the 1950s,' Einemo reminded us, 'with exemplary safety records and continuous improvements in their safety aspects. Today, over 160 ships, mostly naval vessels, use nuclear reactors. So far, all these ships – including Russian icebreakers – use pressurised water reactor (PWR) designs. While they are designed to the highest safety standards, there is one element that makes PWRs difficult to employ for international, commercial operation: they have large emergency planning zones (EPZ). This makes insurance rather problematic.'

'CORE POWER is involved in the development of advanced nuclear reactor technologies that will be suitable for commercial ships, featuring enhanced operational safety, a much smaller EPZ, less waste and long fuel cycles.'

'We are currently focusing on Molten Salt Reactors (MSRs), where the fuel and coolant are combined as a liquid, making a melt-down impossible. Also, as they are not pressurised, the potential for radioactive release to the atmosphere is almost eliminated by design. Hence, the EPZ will be contained, possibly to within the ship.'

'Other designs, such as gas



cooled and liquid-metal cooled reactors where water is replaced as a coolant also have enhanced safety features. All these new designs are based on the fundamental “Defence in Depth” principle for the prevention and mitigation of potential initiating events and applying inherently passive safety systems providing further safety enhancement.

‘The application of new reactor technology to maritime is expected to play a major part towards net zero goals, and I think we will see the first maritime (civil) nuclear propulsion plant projects within the next ten years.’

The technology certainly had its supporters among our Survey respondents.

Smart Green Shipping’s **Diane Gilpin** said that: ‘Nuclear power has greater potential than people currently recognise. Had we begun the decarbonisation journey in earnest when global society first recognised the need to reduce emissions we wouldn’t need to be looking at this expensive solution. But we didn’t and on a risk-analysis basis we need to give this technology serious consideration in the battle against dangerous climate change.’

Baseblue’s **Dyonis Diamantopoulos** reasoned that: ‘As the whole world is moving to a greener tomorrow with clear goals set for the protection of the environment and the better way of running all machines, I feel that it is inevitable at a point to also consider the further development of nuclear technologies including shipping. There is a big debate on the dangers and ethics surrounding nuclear technologies and the potential weaponisation of such, but nuclear is indeed a green technology. Nuclear power produces zero carbon emissions and doesn’t produce any other noxious greenhouse gases through its operation.’

DNV Maritime’s **Eirik Ovrum** said: ‘With the high cost of carbon-neutral fuels, and the

proven record nuclear technology and safety for naval vessels and ice-breakers, I expect to see new pilots coming in the early or mid-thirties. By 2040, hopefully this could have reached a maturity and cost level that could be acceptable for merchant shipping more broadly.’

Edmund Hughes said that: ‘It is evident there is growing interest and development activity on nuclear power being applied in the maritime sector, whether it be for direct propulsion or for use in off-shore power generation to supply the electricity to produce e-fuels.’ His IBIA colleague **Alexander Prokopakis** also noted the interest, but pointed out that we ‘haven’t seen any groundbreaking developments’ yet.

Kasper Søgaard certainly saw the potential of using nuclear power to generate clean maritime fuels, but was cautious about rushing to introduce the technology on the ships themselves. ‘Modular nuclear reactors are very alluring as they – once installed – would eliminate all the complexities around securing zero emission fuels globally,’ he explained. ‘I would however like to see these modular reactors being successfully demonstrated on land – for instance to produce green shipping fuels – before coming with any firm estimate on when they can be introduced as marine propulsion.’

For many in both shipping and the general public, the word ‘nuclear’ continues to trigger fears about safety. **Nigel Draffin** told us: ‘The main obstacle will be public opinion – I have been an advocate since 1968 when I wrote a paper on the topic at training college!’

Perhaps a bit of marketing might help? ‘If only we could have a different name for this technology! “Nuclear” has too many negative connotations and is associated with high risk,’ said UNCTAD’s **Jan Hoffmann**. ‘I believe that the experience of military vessels, and technological progress in this area should allow us to make more and better use of this technology in future.’

Antonio Santos acknowledged that nuclear power has been used on naval vessels, but he still believed that: ‘Its application in commercial shipping poses significant environmental, health, and security risks. Addressing safety concerns, technological challenges, regulatory complexities, and infrastructure requirements, among other key considerations, would be needed to determine the feasibility of nuclear-powered commercial vessels. Other more viable and publicly acceptable solutions already exist to decarbonise ships without having to address the serious concerns related to the use of nuclear power.’

Allyson Browne

was of a similar view, telling us: ‘Nuclear power for ships poses significant cost, safety, regulatory and public perception challenges. Nuclear-powered engines would be extraordinarily complicated and expensive to build and operate, especially at the scale necessary to decarbonise the massive global shipping fleet. At this juncture, I expect to see continued exploration of this technology, but widespread or even sufficient adoption unlikely.’

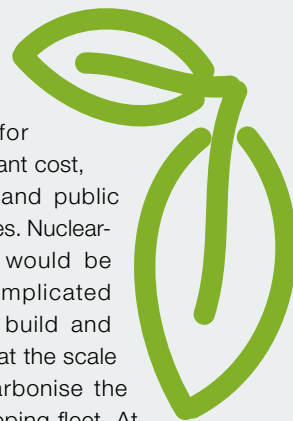
Karl Shrowder believed that having nuclear propulsion available on a commercial scale is ‘not going to happen in our lifetime’ as ‘public perception will not just flip a switch’ and ‘these reactors require scientists onboard to operate them like a naval vessel’. However, like Jan Hoffmann, he did expect to see progress on ‘smaller scale reactors used in producing zero and negative carbon fuels’.

Anthony Mollet of the Marine Fuels Alliance was not dismissive of the technology, but ‘did not believe the whole shipping industry is suitably informed or prepared for a nuclear solution at this time’ – adding that ‘safety concerns and crew training would be a tremendous hurdle’.

Albert Leyson of Drew Marine also picked up on the crew training issue and suggested: ‘We would have to develop an entirely new level of mariners capable of running, maintaining, and navigating nuclear-propelled ships safely around the world. The number of crew required would probably increase dramatically similarly to the level of crew required for operating a nuclear-powered military vessel. The exorbitant cost of operating a nuclear-powered ship would be something only government militaries would be able to afford. Let’s not forget the additional costs that would be required to handle and store spent nuclear fuel.’

John Nicholson was among those who did expect to see more progress on nuclear propulsion – but he cautioned that it will ‘bring with it various challenges and changes required to be made in terms of insurance, safety, port legislation, navigational corridors and security’.

And finally, RINA’s **Tom Barlow-Brown** was keeping an open mind on the issue, answering our question with a ‘Yes and no’ and adding: ‘I’m under the impression that the costs associated with developing the new technology are still too high to even be viable within the next decade. Although nuclear power is used in some specialised cases, it still remains out of reach for most ship owners/operators.’



Emission control

The European Union's Emissions Trading System and FuelEU Maritime come under the spotlight

With effect from 1 January 2024, the European Union's Emissions Trading System (EU ETS) now also encompasses the shipping industry. Meanwhile, FuelEU Maritime is also looking to reduce shipping's emissions and is likely to have a profound effect on the industry.

Do you regard shipping's inclusion in the EU ETS as a positive move which will help to support the maritime industry's decarbonisation efforts?

'Shipping's inclusion in the EU-ETS is, for sure, a positive move towards meeting global decarbonisation goals by creating a level playing field and placing a powerful financial incentive on ship owners to reduce their greenhouse gas emissions,' said **Harriet Robson** of Transparenssea Fuels LLC.

'That said, the transition to decarbonisation, in Europe and elsewhere, will inevitably not be perfect. Given that companies will have to pay for their ships' carbon emissions following shipping's inclusion in the system, there are some factors that must be considered. In my opinion, whether EU ETS truly delivers progress on maritime decarbonisation will first and foremost depend on economical calculations by shipping companies: will the inclusion drive business away from Europe as shipping companies avoid EU port calls and the new, additional costs involved? This, in turn, could increase a vessel's GHG emissions by taking longer routes and partial, more frequent bunkering. Given the move is a gradual one to be phased in over the coming three years, it will be interesting to follow how well the inclusion of shipping contributes towards the maritime industry's decarbonisation goals globally.'

ZeroNorth's **Soren Meyer** also saw shipping's inclusion in the EU ETS as 'a great step towards decarbonisation' – but added that it is 'only the first step'. Meyer explained why: 'It creates a set of

rules that can be used immediately as a lever and generator of genuine change.

'By design, compliance will increase costs for companies who exceed their emissions threshold, presenting a significant risk to organisations that are unable to meet the requirements. This will add complexity for owners and operators, requiring them to find the right solutions to adjust.'

'Adopting long-lasting processes and tools which will help companies navigate tightening regulations and decarbonisation rules is critical,' Meyer emphasised. 'Data will play a pivotal role in managing compliance and driving meaningful emissions reductions, as accurate and reliable data enables the assessment of a vessel's environmental impact and sustainability progress.'

'However, the maritime industry still currently suffers from fragmentation when collecting and reporting data. As such, it is important for organisations to prioritise solutions that bring together information from across the value chain. This will help to deliver a comprehensive view of operations and enhance collaboration as we work together to decarbonise shipping.'

ENGINE's **Erik Hoffman** was another who saw the current situation as 'a good start', adding: 'Whichever way you look at it, the price of emitting CO₂ from ships in the EU has now gone up. That will increase the real prices for carbon-rich fuels like VLSFO and LSMGO. The question is whether this carbon-cost will be great enough to make it more lucrative to burn fuels with low- and zero-carbon potential like sustainable bio-fuels, methanol or ammonia. So far the answer is "no". We will need a much higher EU Allowance (EUA) price for even the cheapest sustainable biofuel to be cost-effective.'

'I think it was important for the EU to get shipping included in its ETS, even if the phase-in was always going to be toothless in its initial impact,' Hoffmann continued.

'I think it was important for the EU to get shipping included in its ETS, even if the phase-in was always going to be toothless in its initial impact'

*Erik Hoffman,
ENGINE*

‘Once shipping is in, the EU can decide to cap the number of EUAs at a lower level to push up the price and make carbon-rich fuels less attractive against alternatives.’

‘Global policymakers need ambitious national and regional trailblazers to draw inspiration from, to realise that it is possible to ramp up the level of ambition. We have seen this recently at the IMO level, where a global fuel standard and other measures similar to those in incoming EU regulations have been proposed and debated.’

Dyonisis Diamantopoulos said that Baseblue supports the EU ETS ‘as it puts a price on emissions and incentivises reductions’. He continued: ‘If the price gap between fossil and alternative fuels remains 2-3 times, the transition won’t materialise. That is why we are supporting and advocating a global (IMO) economic measure that will close or narrow the price gap. As the inclusion of shipping in ETS, along with other industries as seen since 2005, is a political decision, we are dedicated to support this change and see our role as to advise and facilitate our clients’ compliance.’

‘The EU ETS is an incentive to provoke action in the context of improving vessel efficiency and reducing greenhouse gas emissions. It is a move that has triggered a change in our industry; a change that brings many challenges to the table, but yet again it is another chance for the maritime industry to prove its resilience and adaptiveness as with different regulatory changes/mandates in the past (i.e. 0.50% sulphur cap in 2020). As the EU ETS applies to all vessels regardless of flag state, we do not foresee negative impact on the European ability to act competitively in regards to import or export and it doesn’t disrupt the maritime industry. As such, the EU ETS can be a measure that would assist to the general goal of reducing and eliminating emissions by 2050.’

Diamantopoulos concluded: ‘Clearly the inclusion of shipping in the EU ETS will strengthen the possibility and the argument of other national similar emission taxation systems but also potentially a wider overall superseding IMO emanating emissions taxation, that will potentially arise in the upcoming years.’

For NAPA’s **Pekka Pakkanen**: ‘Shipping’s inclusion in the EU ETS is more than a change in regulation; it’s a positive step towards further consolidating the cultural transformation required for shipping’s decarbonisation. By putting a price on carbon, it is arguably the most powerful incentive we currently have to act on, addressing the growing urgency of the energy transition and making tangible GHG emissions reductions.’

‘While the scale of change is monumen-

tal, this is not an overnight transition. Nor is EU ETS an isolated landmark. Change has been brewing across shipping on multiple fronts: Recent milestones, including the IMO’s revised GHG strategy, have provided the industry with greater clarity on what progress will be expected this decade, while digital and clean technology solutions are empowering shipping to take action for immediate, planet-positive impact.

out challenges, such as the complex inclusion of voyages outside EU waters. If problems occur this could prove an enforcement problem. There are also some arguments from within the industry that significant revenue for allowances may impact freight rates and raise costs. This is especially concerning as geopolitical issues are also impacting routes – thus meaning longer voyages. Potentially exacerbating the problems.’

‘If the price gap between fossil and alternative fuels remains 2-3 times, the transition won’t materialise. That is why we are supporting and advocating a global (IMO) economic measure that will close or narrow the price gap’

Dyonisis Diamantopoulos, Baseblue

‘Organisations have already started making the step-change by gathering a deeper data-driven analysis of their fleets’ operations to understand their emissions, past, present and future. This allows decision-makers to take strategic steps to buy the right allowances at the right times, work out any cost sharing mechanism with stakeholders up and down the chain, and unlock efficiency gains that will reduce CO₂ emissions from their voyages, which is after all the main objective of EU ETS.’

‘With solid simulation and data analysis tools, owners and fleet managers can better understand their fuel consumption patterns to predict their likely fuel consumption and emissions. With this insight, they can take proactive measures to minimize emissions, fuel costs and, therefore, the need to buy allowances.’

Sustainable Shipping Initiative’s **Steven Jones** judged that maritime’s inclusion in the EU ETS is a ‘generally positive move’ that will support decarbonisation, but he warned that it comes with ‘a very challenging complex set of arrangements’. He explained: ‘On the positive side, the phased introduction ramps up coverage gradually rather than shocking the system. This onboarding approach helps the industry adjust. Another part of avoiding shocks is the fact that the Monitoring, Reporting, and Verification (MRV) leverages existing EU systems, so again minimising new administrative burdens.’

‘That said,’ Jones continued, ‘it is not with-

Furthermore, Jones said: ‘There are concerns that a patchwork of systems could increase industry complexity instead of one unified IMO plan, but that said there is a strong case that EU ETS can serve as an influential pilot to advance climate action.’

Idwal’s **John Nicholson** believed that: ‘Any system which costs shipowners I believe will force them to try to reduce their CO₂ emissions. However, I also believe that much of this cost will be put onto the end user. In regard to it being implemented correctly, I believe the EU ports could have better infrastructure and offer better alternative fuel options. I also, do not think this will expand past the EU.’

DNV’s **Tore Longva** judged that: ‘The EU ETS has put more pressure on IMO to further regulate shipping. However, at DNV we have always maintained that as far as possible shipping regulations should be global and not regional. In addition, it is not clear whether the EU would sunset FuelEU Maritime and the EU ETS for shipping if IMO implements credible regulations.’

‘Although currently the price is not high enough, the EU ETS would start to cover the price gap between fossil and sustainable fuels. The supporting delegated and implementing act came late in 2023 so the time for implementation has been very short. There is significant work going on to manage contracts to handle the cost of emissions. The EU ETS should also be considered in light

of the introduction of FuelEU Maritime (FEU), and there are questions as to whether both regulations are needed at the same time.'

The interplay Longva identified between the EU ETS and FuelEU Maritime will be the subject of our next question on the survey. Longva's point about the interplay between the EU and IMO was also picked up by many of our respondents.

Nigel Draffin said that: 'The IMO tends to notice what the EU does and follows a little later but I believe the IMO version is likely to be better suited to the marine sector.' Monjasa's **Almanda Terese Molter** agreed that 'having a push from the EU can strengthen outcomes at IMO', but she warned that: 'Implementing too many different regional measures can be problematic in an industry that is truly transboundary in nature. Thus, it is encouraged that global economic measures are implemented to ensure a level playing field.' **Diane Gilpin** of Smart Green Shipping said that: 'Regional schemes are sub-optimal and EU ETS is less-than-perfect but as a market driver EU ETS is definitely encouraging a positive mind shift to pragmatic, short-term solutions like wind assist.'

Anthony Mollet of Marine Fuels Alliance was forthright: 'For such a scheme to work and to be logical and truly beneficial to the environment, it surely has to be a global initiative and launched from the outset. The vagaries and complexities are significant. The very nature of shipping's business, the movement and transition between territories and global regions, means that while EU ETS is a positive move for environmental benefits, it surely can only work if covered globally.'

IBIA's **Alexander Prokopakis** also maintained that: 'The solution for the maritime industry's decarbonisation needs to be on a global scale, an IMO initiative for example.' His IBIA colleague **Edmund Hughes** had reservations over both the EU ETS and the prospect of a global ETS.

'When you review the various EU instruments that have been made to enact the requirements of both EU-ETS and FuelEU Maritime it demonstrates why many consider shipping a unique industry sector,' said Hughes. 'As such there are significant concerns that whilst the intention of reducing shipping emissions is clear, implementation for the sector is not only challenging but also runs the significant risk of non-compliance/evasion (carbon leakage). Also one aspect that does not seem to have been considered is the cost of compliance. Whilst larger shipping companies may have resources to manage the risk of compliance it is arguable that smaller operators are likely to have

no choice but to outsource the management of compliance. Doing so means they may no longer be able to readily judge the risks.'

'There has been no real appetite shown for a global ETS by Member States of the IMO,' Hughes told us. 'Indeed even the EU/EC have indicated that they would support a levy/contribution based economic measure (already proposed by several IMO Member States and separately by ICS) if combined with a global GHG fuel standard (proposed EU, China and separately by ICS with IBIA).'

Adrian Tolson of 2050 Marine Energy was pragmatic. 'I would prefer a global system,' he said, 'but realistically this might never happen, so we can be thankful for this work. It goes to show that action even in a region or grouping of countries can really have an impact on global shipping and decarbonisation.' UNCTAD's **Jan Hoffman** was of a similar view, saying: 'At times, the perfect is the enemy of the good. We would love to have an ambitious multilateral solution. By advancing with its regional solution, the EU has added pressure to the multilateral system – which is, in my view, a good thing.'

Kasper Søgaard of MakingSense also felt the EU ETS could be a driver for global change. 'To make zero emission shipping commercially viable,' he maintained, 'there needs to be a price on GHG emissions and this is what the ETS does, despite it being too low to drive the uptake of green fuels on its own.'

about the perceived benefits of maritime's inclusion in the EU ETS. **Nicholas Woo** of Birketts said: 'Although it is too early to tell, the massive increase in costs resulting from shipowners having to purchase EUAs could result in an adverse impact on the European (and consequently global) economy.' Nautical Supply International's **Karl Shrowder** said: 'It's a move for the European Commission to pocket lots of money into the coffers and not meet the investment needed to really scale up the use of energy efficient technologies for maritime.' On a more positive note, he added that: 'It shouldn't be difficult for shipowners, charterers, operators to implement ETS into their business practice if they are speaking with industry experts or brokers who are geared up to help their customers.'

Our respondents from among the climate NGOS were pleased with the move, with both **Nuala Doyle** of Opportunity Green and **Allyson Browne** of HACC describing shipping's inclusion within the EU ETS as a 'positive step' – but Browne maintained that: 'Its effectiveness will depend on implementation and global alignment on emissions trading. It was very smart for the EU to take this step first, because the bloc effectively set the rules of the game for emissions trading in shipping. Now, other countries have a model policy to consider and learn from, and the IMO basket of measures could take the ETS for shipping global – effectively standardising the

'The IMO tends to notice what the EU does and follows a little later but I believe the IMO version is likely to be better suited to the marine sector'

Nigel Draffin

It also sends a clear signal that the EU will not wait for the IMO, which should make the adoption of a global GHG price at the IMO, which is what we really need, more likely.'

The IWSA's **Gavin Allwright** said that there are 'gaps and omissions' in the EU ETS that 'make it less beneficial than it could be' and 'a global carbon pricing system would be the best option' – but 'we have a very short window for action, therefore waiting another four years for a global levy is not really an option'.

Some of our respondents were sceptical

EU's policy. What a first mover advantage!

Doyle added that, when looking at both the EU ETS and the regulatory framework introduced with the FuelEU Maritime initiative: 'More can be done to incentivise the adoption, and drive supply, of the lowest emission, green hydrogen fuels. Transitioning towards the lowest emission alternative fuels will be central to the maritime sector's decarbonisation, so we need to see stronger regulations in place to drive the use of green hydrogen fuels over alternatives with less potential to

lower emissions to complement other measures such as shipping's inclusion in the ETS.'

For Environmental Defense Fund's **Sofia Esquivel Elizondo** and **Panos Spiliotis**: 'The EU ETS is a first of its kind climate measure that is already moving the needle in shipping decarbonisation. By putting a cost on harmful emissions, the EU ETS will hopefully alter the commercial calculus in favour of zero-carbon shipping. It will not only make zero-carbon fuels more attractive to produce, but it will also incentivise optimised speeds and Energy Saving Technologies. EDF commissioned research, however, shows that it will not suffice to reduce emissions – for that we will need a strong basket of measures at the IMO.'

The EU will also be looking to reduce shipping emissions through the FuelEU Maritime initiative starting in 2025. As part of the 'Fit for 55' package, the FuelEU Maritime aims to reduce the GHG intensity of marine fuels by 2% in 2025 and up to 80% by 2050.

Do you envisage that the EU ETS and the FuelEU Maritime initiative will complement each other effectively?

Some of our Survey respondents answered this question with a 'Don't know', but most seemed optimistic. Baseblue's **Dyonisis Diamantopoulos**, for example, told us: 'I do believe that these two are designed to harmoniously work and click together. EU ETS on one hand is a taxation basis on how much you emit – based on your EU MRV data. FuelEU on the other hand is a mandate to include certain amounts of alternative fuels in the fuel mixture of a vessel/fleet in order to reduce greenhouse gas intensity index of a vessel.'

'EU ETS is calculated on a tank-to-wake basis of the fuels consumed whereas FuelEU is calculated on the basis of well-to-wake. FuelEU, if we take into account the equation of the GHG intensity index of a vessel, has to do solely with the types of fuels used. A baseline has been set at 91.16 grams CO₂e/MJ that is to decrease in 5-year periods starting 2025. All vessels would have to comply alone, or in a pooling basis (for vessels under same DoC holder) to that regulation. Non-compliance would translate to high fines that would far supersede the cost of compliance. Using alternative fuels to comply with the FuelEU part of the regulation will also overall decrease the emissions produced and subsequently lowering the EU ETS cost and the number of needed EUA units to be procured.'

'The key for compliance with both aspects of the regulation is correct data and calculations, and of course proactivity. Since alternative fuels will have to be used it would be

prudent for shipowners to conduct trials before the commencement of the enforcement period of FuelEU. This would imply a process of securing avails, finding the appropriate biofuel and blend that is to be tested, discussions with engine manufacturers that would give the green light for usage of such alternative fuels among other actions.'

Adrian Tolson of 2050 Marine Energy gave a neat summary: 'Carrots and sticks seem to work well together and anything that sets for goals GHG intensity while providing financial incentive to use lower GHG fuels would seem to make sense.'

ENGINE's **Erik Hoffmann** explained how the ETS and FuelEU Maritime will take on shipping emissions with a one-two combination. 'The ETS is initially projected to be the most impactful, and then be overtaken by FuelEU Maritime in terms of compliance costs from around 2035,' he said. 'The ETS makes it more expensive to burn conventional fuels, but not enough to trigger a fuel switch on its own. FuelEU Maritime's steep non-compliance penalties will make it prohibitively expensive to keep burning purely conventional fuels. It's a gradual fuel-switching regulation, while the ETS is a carbon tax.'

DNV's **Tore Longva** agreed that ETS will initially have the higher impact with FuelEU

55 Package, addressing emissions and alternative fuel uptake in all shapes with supply through the Renewable Energy Directive III, demand through FuelEU Maritime, infrastructure through the Alternative Fuels Infrastructure Regulation, and putting an additional incentive to transition by putting a price on emissions through the inclusion of shipping in the EU ETS. It is a well-rounded legislative framework to facilitate the transition of the shipping industry.'

MakingSense's **Kasper Søgaard** judged that: 'In many ways the EU Fit for 55 includes the two elements that are likely to be needed also at the IMO level: a carbon price (ETS) and a technical measure to drive the uptake of zero emission fuels (FuelEU maritime).'

Steven Jones of Sustainable Shipping Initiative took a similar line, and also identified some future improvements. He explained: 'The EU ETS and FuelEU Maritime initiative have the potential to work as complementary policy measures. Indeed, that is the design, ETS creates a carbon price incentive and FuelEU Maritime sets specific sustainable fuel use targets to achieve cuts.'

'The ETS addresses all CO₂ emitted, with FuelEU Maritime tackling emissions by transitioning fuels. Combined they cover multiple angles and together

'At times, the perfect is the enemy of the good. We would love to have an ambitious multilateral solution. By advancing with its regional solution, the EU has added pressure to the multilateral system – which is, in my view, a good thing'

Jan Hoffman, UNCTAD

Maritime becoming more significant as we head towards 2040. Longva added that: 'The introduction of the FuelEU Maritime initiative also raises the question of whether there is still the need for a price on GHG emissions through ETS, as the FEU implicitly has a pricing mechanism through the pooling option. As such the price gap is more effectively closed through the FuelEU Maritime than with ETS.'

Almanda Terese Molter considered that: 'The EU have been quite clever in their Fit for

provide both a push and pull incentive.

'Taking synergy even further, revenues from the ETS can even help fund the deployment of low-carbon fuels required under FuelEU Maritime. As revenue will go into the "Ocean Fund", funding innovative decarbonisation projects in the EU, with the rest going to Member States to specifically pay for maritime decarbonisation projects such as port modernisation and alternative fuel trials. Perhaps even more impor-

tantly the funding will also likely support projects in developing countries, thereby magnifying the positive effect and impact.

'That said,' Jones continued, 'there are still, as may be expected, potential challenges to overcome. There needs to be alignment on lifecycle emissions, and accounting methodologies for fuels. There also needs to be a means of managing potential carbon price volatility under ETS interacting with fuel mandates. Overall, though, the two policies can work in concert over different timescales by bringing complementary market and regulatory mechanisms.'

IBIA's **Edmund Hughes** said that: 'Whether they complement each other remains to be seen but they are designed for different purposes and as such this may lead to distortion in the market.'

'The major concern,' Hughes continued, 'is the availability of lower GHG intensity compliant fuels that meet the requirements on a "Well-to-Wake" basis that is where the GHG intensity of the fuels is reduced across the whole production/supply/combustion chain. If these fuels do not come onto the market by the required deadlines then ships will not be able to comply

and may either not be able to trade into the EU and/or face penalties for compliance.'

Environmental Defense Fund's **Sofia Esquivel Elizondo** and **Panos Spiliotis** believed that the two initiatives will work together for a common objective. Indeed, they maintained that: 'Fuel EU was an absolutely necessary addition to EU ETS because for most ocean-going ships, the effective carbon price felt over their annual operations would not have sufficed to boost the use of alternative fuels. Fuel EU will now provide industry with certainty about the maritime energy transition whereas EU ETS will amplify the signal, incentive efficiency, and generate useful revenues.'

Allyson Browne said much the same thing – telling us that 'ETS will be providing economic incentives and the FuelEU Maritime establishing mandates for fuel GHG intensity reduction'. She added: 'The initiatives encourage first mover adoption as well as gradual uptake, while providing mechanisms for financial support. While we're likely to see implementation challenges to the initiatives, they are slated for success.'

Gavin Allwright felt that the EU initiatives will complement each other 'to a degree', but he added that: 'The target levels in the

FuelEU Maritime regulation are rather unambitious, especially in the lead up to the critical 2030 point. This is the EU technical measure which is an example of the GFS [Global GHG Fuel Standard] that is being considered at IMO and within this regulation there are clear choices that are made that are challenging: one is the provision of a 2x multiplier given to renewable fuels of non-biological origin (RFNBO) within the formula which is to assist with uptake and the build out of infrastructure. This obviously excludes biofuels, but it also excludes wind propulsion energy sources, thus creating an un-level playing field, mitigated to a degree with a small 1-5% bonus for use of wind propulsion added to calculation.'

Smart Green Shipping's **Diane Gilpin** also identified the same issue, and called for a broader vision. 'As we move into a new future,' she urged, 'we need to look beyond simply substituting one fuel with another and look at the wider system solution. FuelEU – the clue's in the name – has had too narrow a focus, and has systematically overlooked the economic and environmental benefits of complementary solutions like wind assist, route optimisation and innovative new ship designs.'



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Trend analysis

Our Survey respondents focus on current trends in the quality, availability and pricing of marine fuels

While the shipping industry is gearing up for the ‘new fuels’ like ammonia and methanol, the vast majority of the world’s global fleet is still comprised of vessels running on traditional bunker fuels. Consequently, sourcing these fuels in the right quantities, in the right locations and at the right price and quality specification is still the bunker buyer’s primary task.

Have you noticed any particular quality trends with any of the main marine fuel oil and gasoil grades in 2023?

Drew Marine’s **Albert Leyson** reported that: ‘In 2023, clearly VLSFOs have continued to be problematic to some ship operators. In most cases, the classic telltale sign of fuel instability is often foreshadowed by an elevated total sediment result that is equal to or just under the maximum specification allowable limit of 0.10% m/m or otherwise exceeded it. The more interesting cases are when the VLSFO meets the ISO 8217 specification in full, and yet, the onboard crew still encounters consid-

erable amounts of sludge formation in storage tanks and/or during centrifuging and filtering.

‘As one of the major additive marketers of specialised fuel treatment chemistries, the overall global demand in 2023 for Drew Marine’s fuel stabiliser-type additives specifically has decreased in relative terms by around 10% from prior year. Now, there could be any number of reasons to explain this change in demand apart from the obvious whereby certain ship operators have switched fuel additive suppliers. Or is it because VLSFO quality has actually gotten better?

‘If VLSFO has in fact improved in quality,’ Leyson speculated, ‘one likely reason could be attributed to the increased use of more compatible fuel blend components by bunker suppliers thus resulting in a more stable VLSFO. Another possible reason could be the increased usage of stabiliser-type additives upstream for the creation of stable VLSFO blends from less compatible blend components. Ultimately, in a broader sense and without corroborat-

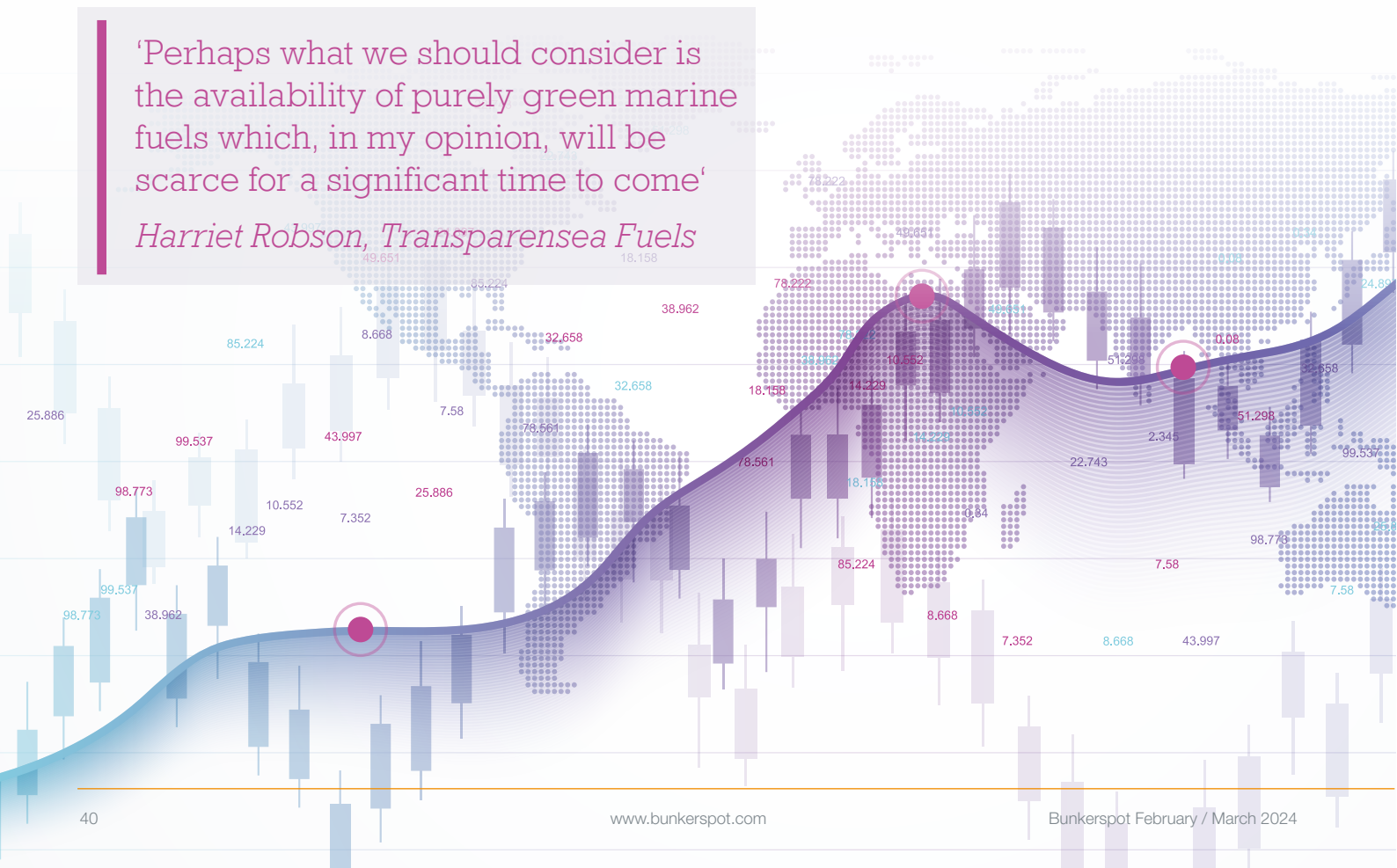
ing with upstream bunker players and other additive marketers, there is really no way of knowing whether it’s one reason over another that would explain the decreased demand for fuel stabiliser-type additives.’

Nigel Draffin noted that: ‘The increase in data on analysis and correlation with problems with VLSFO is changing our understanding of the interrelationship between TSE, TSA and TSP in this fuel. This in turn is helping to improve the stability of the blends.’

Adrian Tolson of 2050 Marine Energy said ‘I think it’s fairly clear that 0.50% fuel oil in most of the world is generally a blend of sometimes challenging components that don’t always work so well together. This creates on-going potential problems for VLSFO supply in almost every port in the world. On the other hand, HSFO is generally very stable and reliable (although not particularly cheap anymore) but does once in a while lend itself to the introduction (mostly through ignorance rather than malice) of contaminants hidden in plain sight in the complex chemistry of residual fuel.’

‘Perhaps what we should consider is the availability of purely green marine fuels which, in my opinion, will be scarce for a significant time to come’

Harriet Robson, Transparensea Fuels



Chris Turner drew upon Integr8 Fuels' market knowledge to give a check-up on the quality trends of the main grades: 'VLSFO is seen to be almost at parity with the previous period although is trending down in Q4 and has continued to do so.

'The quality index for HSFO has trended upwards generally; this is explained by a reduction in high-risk claims such as TSP and AISi.

'LSMGO is seen to be trending slightly down. Sulphur remains responsible for around one third of all off specification incidents and Flash Point slightly reduced by around one quarter.'

Allyson Browne of HACC cautioned: 'There are absolutely quality variations in fuel oil grades, with some regions experiencing more off-spec issues than others. Now and moving forward – especially as we transition into the rainbow world of hydrogen and other alternative fuels – continuous monitoring and reporting are vital to maintaining fuel quality standards and accurate well-to-wake emissions accounting.'

Focusing more specifically on trends over the past 12 months or so, Nautical Supply International's **Karl Shrowder** said: 'We haven't seen any huge shocks this year or unstable cargoes that raised concern since the discrepancies rose in 2022 (when we saw adjustments in trade flows following the Russian oil embargo which saw VLSFO blending techniques altered accordingly).'

Do you believe that, overall, there is sufficient availability of HSFO, VLSFO and MGO in the main bunkering ports to meet the industry's needs for the different grades?

'Generally,' reported Baseblue's **Dyonisis Diamantopoulos**, 'VLSFO and LSMGO are available in most ports around the world with a few exceptions. HSFO also can be found in the vast majority of larger ports and bunkering hubs. Availability issues could arise for parts of the world depending on the flow of marine traffic and general local situations, occurrences such as weather conditions, refinery shutdowns or maintenance. At the moment we have observed some tightness in the Singapore market for VLSFO and HSFO for example with prompt deliveries being priced at high premiums. Overall, we believe that general availability are fine for the conventional fuels.'

Harriet Robson of Transparensa Fuels noted: 'Supply levels are meeting demand. There are, however, some factors to consider; as Russia's invasion of Ukraine will soon enter its third year, the market continues to feel some loss of supply from the region and with the ongoing disruption to shipping activity in the Black Sea, we have seen increased activ-

ity on the neighbouring bunkering hubs which impacts supply and demand levels. And, of course, the unrest in the Middle East and vessel attacks in the Red Sea is what everyone is focusing on for the start of the year so far.

'Immediate product avails in Singapore were questionable in mid-January as vessels maximised their intake to facilitate a longer diversion around the Cape of Good Hope, which will indirectly impact supplies in the long term with longer shipping routes and higher costs involved. Also, as the industry moves towards its decarbonisation goals, some question whether the availability of conventional fuels will remain at current levels or drop

'If the Middle East remains unstable, shipping routes and bunker demand may alter, even without any decarbonisation motivation'

*Mark Williams,
Shipping Strategy*

due to lower demand; specifically, HFO which some believe could be phased out as fewer ships are fitted with EGCS. Perhaps what we should consider is the availability of purely green marine fuels which, in my opinion, will be scarce for a significant time to come. 'Fuel availability seems OK to me,' said **Adrian Tolson** of 2050 Marine Energy. 'HSFO is not always easy to find if there aren't lots of container ships or cruise ships (with scrubbers) around. VLSFO and MGO are mostly easily available. Oddly enough in some container dominated ports HSFO is easier to find than VLSFO and – fun fact – did you know more than 50% of the fuel supplied in North America's main bunker port – New York – is HSFO?'

Karl Shrowder noted: 'There have been product shortages of HSFO in ARA since the adjustment in oil flows following the EU embargo on Russian sea-born oil trade. However the new cargo flows from East Suez has given some relief but at a cost hence premiums have remained firm. Nonetheless we did see the scrubber spread reach almost parity in some ports within the Med region due to the inelasticity of HSFO pricing and

predictable demand whilst shipowners continue to install scrubbers. Singapore recently experienced some tightness in product but it's never been enough to the point where tanks have been dried out. The VLSFO tightness in Singapore following the Al-Zour refinery closing in Kuwait buoyed VLSFO premiums and widened the scrubber spread since flows dried out and cargoes came from further afield. As long as we have security of product in key regions we should have sufficient availability of product in the major hubs to be able to meet demand of conventional fuels.'

Have there been significant changes in the price differentials between VLSFO, HSFO and MGO/MDO in 2023, and do you expect this trend to continue in 2024?

'YES!!' said 2050 Marine Energy's **Adrian Tolson**. 'If you had told me that in 2023 that it was possible to arb a cargo of HSFO from Singapore to the ARA (after 40 years of the opposite arb!) then I would have called you all crazy. VLSFO was also very cheap in the ARA – perhaps less of surprise than the HSFO – but it was pretty amazing for me to learn that VLSFO cargo resupply in Panama was now being based on Rotterdam 0.5% barges!! – removing another benchmark (USGC based) of more than 40 years! Overall, the Hi5 spread came crashing down – almost reaching parity in some locations. Winter in the northern hemisphere seems to have redressed some of the pricing madness, but I think insanity returns later in 2024. And the cause of all this was of course sanctions of Russian crude and products and those countries that seem able to come to terms with the morality of supporting that regime.'

Allyson Browne observed: 'Wars and conflict continue to impact global oil prices, regional availability and demand. Given current affairs, this trend is likely to continue into 2024.'

Karl Shrowder said that: 'Some cargo flows have been affected following the Red Sea disruptions in the final month of 2023. KPC maintenance in Europe will likely increase the pressure in the arbitrages. The narrowing scrubber spread is due to the additional transshipment costs and blending along the supply chain has seen the narrowing of the spreads on the front end around August and September this year.'

Do you believe that we may see a shift in bunker demand – in terms of both individual ports and geographical regions – over the next few years?

'Bunker demand in an area is directly correlated with the marine traffic of said area,' **Dyonisis Diamantopoulos** told us. 'Different

factors could affect that. For example, there could be some droughts in an agricultural exporting area that could curb the production and the subsequently lower quantity of grains exported would result in a lower number of vessels sailing to and from the area and a drop in the local and surrounding area bunker market. Moreover, sanctions and geopolitical tensions could affect areas in such ways, as for example in the recent times Ukrainian, Russian ports and Turkish straits were affected by the turmoil between Russia and Ukraine and trade was also affected by the imposing of sanctions, or the Red Sea attacks from the Houthis that provoked a change in vessel routing. Again, it is difficult to estimate and guess what is to happen as it is unknown when or how different geopolitical events will end or transpire.'

that we were unlikely to see any major shifts before 2030, adding: 'Still 60% of bunkers will be sold in China, S Korea, Singapore, UAE, Rotterdam and USG. However, if the Middle East remains unstable, shipping routes and bunker demand may alter, even without any decarbonisation motivation.'

Adrian Tolson of 2050 Marine Energy felt there were undercurrents at work that will bring changes in bunker demand. 'I don't think in the shorter term this is a dramatic shift but longer term alternative fuel supply will change bunkering/supply patterns,' he said. 'Shorter term demand is obviously affected to some extent by wars/low draft in canals and other geopolitical events – but the key cargo ports keep their dominance as far as bunker supply is concerned. Medium and longer term demand can and will shift to

result of adopting a fuel with a lower energy density, meaning you will refuel at least twice as much as lifting conventional bunkers which are energy rich. With maritime still reliant on VLSFO for bunker supplies, refineries in south China have been ramping up their output which will likely make Zhoushan more attractive for owners traveling to far east Asia over lifting in Singapore.'

RINA's **Tom Barlow-Brown** looked ahead to the 'possibility of a greater number of smaller scale renewable energy and green bunkering options in N.W Europe and the Baltic region – both as a result of innovation by companies in this area and the need to provide greener opportunities due to EU regulations'.

Allyson Browne felt that the energy transition will open up new opportunities. 'Global trade shifts and evolving environmental regulations over the next few years will absolutely impact bunker demand geographically, with some ports emerging as preferred hubs for specific fuel types or due to strategic locations,' she predicted. 'Many ports have an opportunity to capitalise on their strategic location to become key clean energy hubs, including for fuel bunkering, especially as the energy transition and climate crisis will demand more frequent bunkering, access to charging, and rerouting due to increasing extreme weather events.'

IWSA's **Gavin Allwright** picked out some of the regions which may play an important role in the transition. 'We are entering a period of flux in certain areas, the green corridor developments and relocation of energy sources from fossil to non-fossil and renewable energy sources,' he said, 'so there may well be an accelerated reorientation of energy provision to areas such as Southern Africa, South America or the Mediterranean where alternative/renewable energy resources are high. If these new fuels are going to be tankered to areas of use, then that will be a significant shift in bunkering demand and port use, however this is a longer-term trend than just a few years.'

Steven Jones of the Sustainable Shipping Initiative was sure that change is coming – and we need to prepare for it. 'One only has to look at the geopolitical impacts of conflicts and climate change – the trade flows are first to be disrupted, and that means bunker demand shifts too,' he predicted. 'Ensuring that the right fuels are available in places which do not ordinarily need them is a huge challenge and problem. With so much potential flux in trade flows, ship operations, and energy markets, bunker demand appears prone to redirection between ports and regions over the next few years as shipping reacts to an array of scenarios. Careful fuel planning and supply chain adaptability will be required.'

'With maritime still reliant on VLSFO for bunker supplies, refineries in south China have been ramping up their output which will likely make Zhoushan more attractive for owners traveling to far east Asia over lifting in Singapore'

Karl Shrowder, Nautical Supply International

'In general, we expect that bunker demand patterns will depend on the fuel, and the location of its production and supply infrastructure,' reported Titan's **Michael Schaap**. 'In Europe, there are currently approximately 100 locations where vessels can bunker LNG. The ARA ports (Amsterdam – Rotterdam – Antwerp) maintain a crucial position in LNG bunkering, and we expect this to be the case into the future for LNG and many other clean fuels.'

'Looking ahead to 2024,' Schaap continued, 'the Mediterranean market is anticipated to flourish significantly due to its designation as an Emission Control Area (ECA), starting 1 May 2025. This, together with the stringent reduction in the sulphur limit for fuel oil from 0.50% m/m to 0.10% m/m, will escalate the need for LNG and LBM in the region. Ultimately, the key to meeting worldwide alternative fuel bunkering demand will be to remain flexible, and have versatile operations that can meet customers' needs.'

Anthony Mollet of Marine Fuels Alliance believed that: 'Supply and demand in the key bunkering hubs will remain steady in the next 2-3 years.'

Shipping Strategy's **Mark Williams** said

those ports where alternative fuel is available. It's not that cargo has necessarily shifted but concepts such as mass-balancing allow shipowners to pick up low carbon alternative bunkers anywhere they call and still be able to reduce their fleets overall emissions. For example, Barcelona has recently seen a growth in supply of biofuel blends not because there are more ships or different ships calling there but because there is availability of low priced biofuels in the region.'

Smart Green Shipping's **Diane Gilpin** also believed that the energy transition will bring a shift in fuel buying patterns. 'Bunker demand is changing,' she said. 'Shipping has to compete with other market sectors for scarce, more expensive fuels. This supports wind propulsion and other efficiency opportunities as no-regrets solutions because they all reduce overall fuel demand – a significant economic advantage in a fuel constrained future.'

After noting that 'bunker demand has held steadily over the past couple years and will likely ramp up in South East Asia,' **Karl Shrowder** added: 'The shift in demand will occur once we see new fuels mature in the market and new choke points will arise as a

Clear thinking

Will mass flow meters, bunker licensing and digitalisation bring greater transparency and accountability to the bunker supply chain?



The Port of Rotterdam is set to make the use of mass flow meters (MFMs) compulsory for bunker deliveries – and Singapore has of course already done so. These two bunkering mega-hubs have also been leading the way on bunker licensing, and Singapore has decided to become the first port in the world to implement electronic bunker delivery notes (e-BDN).

Do you believe that the momentum is now building for MFM to become mandatory, or standard practice, in other bunkering hubs too?

Harriet Robson of Transparensa Fuels (which clearly has a strong interest in promoting transparency in bunkering) believed that: 'MFM technology is beneficial to the entire bunkering process and those involved: not only does the buyer have the reassurances that what they get is what they are paying for, but it also benefits suppliers as deliveries are becoming more efficient and less time is spent handling discrepancies and long, drawn out quantity claims.'

'That said, Robson continued, 'given there is still some room for human error, the system remains imperfect. As brokers, we do see more buyers opting for a MFM supply over the more traditional measuring methods however, I am not entirely convinced it is enough to make their implementation mandatory. Despite the more efficient deliveries, I do not see how there would be the full support for a mandatory implementation from every supplier in all ports. Take the latest move by ARA to make them mandatory, this came 9 years after Singapore, and was met with some criticism from various suppliers mainly due to the costs involved and concern it would drive some of the smaller, independent suppliers out of the market, because they could not bear the costs involved. When Singapore made the implementation mandatory, a large percentage of the cost was subsidised by the MPA. Also, as the indus-

try moves towards its decarbonisation goals and we see the adoption of alternative fuels, how the technology will cope with these newer, alternative fuels needs to be clearer.'

MakingSense's **Kasper Søgaard** drew the link between MFMs and decarbonisation: 'As transparency on emissions becomes more important to regulators and shipping customers, the demands for reliable data will keep increasing.'

Nigel Draffin said that MFMs 'will be the preferred choice for most alternative fuels: it has customer acceptance and deliverers are able to realise time savings, but it is unlikely to become mandatory except in ports where the authority has absolute regulatory control'.

IBIA's **Alexander Prokopakis** assured us that: 'More and more ports and stakeholders are discussing it. As carbon pricing will have an increasing role, accurate measurement of supplied fuels will be even more important.'

Edmund Hughes (also of IBIA) pointed out that: 'As we move into an era of carbon pricing the accurate measurement of fuel supplied to ships will become ever more critical. In the end those responsible for paying for the emissions will only want to pay what they have emitted. As such the market will increasingly require bunker operators to use MFM.'

The technology has the support of industry players. Baseblue's **Dyonisis Diamantopoulos** said: 'MFM is a measure that has been/is to be implemented in different ports. We support the use of MFM as a measure that to some extent provides security regarding the quantity delivered, but it needs to be mandatory and enforced by the authorities in order not to distort competition. We believe it is a measure that could potentially assist in transparency and correct practices but on the other hand there have been cases that MFM systems were tampered which proves that they are not "bulletproof" themselves.'

Allyson Browne of HACC was confident that: 'The success of MFMs in ports like Singapore and Rotterdam is encourag-

ing other hubs to consider similar mandates. This trend is likely to gain momentum, offering more transparency and accuracy in fuel transactions. The practice helps reduce disputes and potential fraud in bunkering operations, thereby promoting fairness, trust and compliance. Standardisation of this practice would be a positive development for the industry, which would benefit from increased operational efficiency, cost savings and more accurate compliance.'

Anthony Mollet of the Marine Fuels Alliance felt that: 'It is clear from conferences, presentations, and wide-spread media content that the case for MFMs has been building.' However, he added that a concern raised within the MFA and voiced by several companies during conferences is the impact of investment and implementation.

SSI's **Steven Jones** was positive about mass flow metering but – like Mollet – also flagged up industry concerns over cost and implementation. 'MFMs present clear advantages giving improved accuracy and transparency,' he said. 'So momentum does appear to be building toward their formal adoption in many of the world's top bunkering ports. Though overcoming lingering implementation hurdles will be key, and concerns of costs always seem to come to the fore. That said, the rising tide of big port usage is likely to only lead to more ports – and then suddenly we are likely to reach a tipping point of utilisation.'

Nautical Supply International's **Karl Shrowder** agreed that there is interest in MFM, but was not sure that momentum was building and cautioned: 'MFM only makes sense in a regulated environment. You can say you have MFM, but how is it monitored by the authorities if it's not mandatory in a hub? MFM deliveries are not regulated (only

Singapore) and equipment calibrated and certified for it to work in unregulated markets.'

Adrian Tolson of 2050 Marine Energy was looking for a holistic approach: 'MFM will work in harmony with the rise of alternative fuels/decarbonisation/digitalisation etc. I think it will become readily apparent that the only way for vessels to accurately track the initial input of fuels of different GHG intensities will be by MFMs. It will develop into standard practice for the industry as a whole. Will everyone change at the same time? No – but the more encouragement that comes from regulators, ports, shipowners and alternative fuel suppliers the better.'

Do you believe that other ports will also look to follow Singapore and Rotterdam and implement bunker licensing schemes over the next few years?

'The implementation of bunker licensing schemes by some of the world's biggest and busiest ports like Singapore and Rotterdam suggest a growing trend towards more regulated and standardised practices in the maritime bunkering industry,' said HACC's **Allyson Browne**. 'These schemes allow for greater quality assurance and control, facilitate regulatory compliance and bolster the reliability and integrity of the fuel supply chain. All of these qualities will be critical as we transition to a cleaner fuel supply, and the shipping industry will benefit from a standardised approach to bunker licensing.'

'Tighter control over supplies will be more relevant than ever and Port Authorities will need to act to remain competitive,' judged **Alexander Prokopakis**, and his IBIA colleague **Edmund Hughes** added: 'As the regulatory focus on fuels moves upstream then bunker operators are going to come under a lot more scrutiny by both ship receiving the fuels and the regulatory authorities overseeing those responsible for delivery. For bunkering hubs to remain competitive (ships will want/need to go where they see tighter control over the fuel supplied) they will need to ensure greater quality control of bunker operations and so the likelihood of more licensing schemes being implemented over the next few years.'

'There are two reasons to want bunker licensing,' according to **Adrian Tolson**. 'To regulate the supply and delivery of new alternative fuels and to raise standards and reduce fraudulent practices of the unlicensed industry. It seems to me that these goals are complementary and will create multiple pressures on governments and port authorities to license suppliers.'

Steven Jones believed that: 'More major bunkering ports worldwide will likely pursue implementing bunker licensing schemes over

the next few years. There are some obvious arguments that such licensing establishes quality, safety, compliance, and competency standards, while also giving further integrity and transparency in a historically opaque market.'

'Such an approach also ties into the fact that bunkering standards and oversight are changing globally, and so port licensing

'There are two reasons to want bunker licensing. To regulate the supply and delivery of new alternative fuels and to raise standards and reduce fraudulent practices of the unlicensed industry.'

Adrian Tolson, 2050 Marine Energy

schemes align well with this. Indeed, there are even arguments that large bunkering ports see licensing as a competitive advantage in attracting quality fuel providers and vessels. Which also allows the users more confidence in their own assurance audit trails.'


Jones continued: 'While local factors will determine implementation timing, the foundational licensing model pioneered in Singapore and Rotterdam points to wider adoption by major bunkering hubs seeking to boost standards.'

'There is also the small matter of port authorities being able to use licensing fees and charges on suppliers as significant revenues generation tools. While the ongoing license renewals can also provide ports with a continuous revenue stream.'

Do you see mandatory eBDNs as a positive development for the bunker industry?

Anthony Mollet kept it brief: 'There is not really a case against electronic bunker delivery notes. It is clear the technology works and they provide great assurance for all involved in the supply.'

Kenneth Juhls explained why ZeroNorth is a supporter of



‘There is not really a case against electronic bunker delivery notes. It is clear the technology works and they provide great assurance for all involved in the supply’

Anthony Mollet, Marine Fuels Alliance

per year, mandatory eBDNs can contribute to a more productive, sustainable and eco-friendly bunkering industry.’

Baseblue’s **Dyonisis Diamantopoulos** was succinct, but equally positive: ‘We believe eBDNs are a positive development in the maritime industry for reasons of transparency and compliance, record keeping, easy access, and tracing to name a few.’

Alexander Prokopakis saw Singapore’s move as ‘a major step for digitalising the bunker industry,’ adding that ‘others will follow soon’. **Edmund Hughes** pointed out that: ‘IMO now accepts eBDNs and so again even where not a mandatory requirement, shipping companies are likely to increasingly want ‘digital’ records for demonstrating to regulatory authorities their compliance with requirements.’

Hughes also believed that: ‘There will be a growing focus on quality control and assurance of fuels upstream from the ship. This focus will require greater verification and certification of fuels prior to delivery to the ship. It may even require the bunker operator to have its operations verified and certified and as the carbon footprint of those operations will need to be incorporated into the “GHG intensity” of the fuel being used by the ship. All this will require “paperwork” which increasingly will be digitalised.’

For **Allyson Browne**: ‘The implementation of bunker licensing schemes and mandatory eBDNs are progressive steps towards a more regulated, transparent and efficient maritime bunkering industry. The Maritime and Port Authority of Singapore’s initiative to implement eBDNs and its plans to make digital bunkering mandatory from 2024 signals a significant digital shift in the maritime industry. eBDNs enhance efficiency and accuracy, improve transparency and traceability, reduce administrative burden (time and cost savings) and facilitate better data management and analysis by integrating with other digital systems. As the industry advances digitalisation, eBDNs are likely to become industry standard.’

Nigel Draffin was pleased that IMO has acted to approve eBDNs so they are compliant with MARPOL, but he believed that the uptake outside the main ports may be ‘very slow’. Nautical Supply International’s **Karl Shrowder** said that: ‘If we are to introduce digital bunkering into maritime’s digitalisation revolution then it will need to be driven by market neutral participants who take into account full transparency of the process and not having a vested commercial interest.’

Steven Jones judged that: ‘The mandatory implementation of eBDNs is another of those natural turning points as shipping makes its evolution to a fully digitalised industry. Replacing manual paper-based documentation with real-time sharing of delivery details between suppliers, ports, and ship operators is an important giant step forward.’

‘This will significantly enhance visibility across bunker transactions. Indeed, the use of eBDNs is really the third pillar of modern bunkering. Used alongside mass flow meters and licensing schemes, there is the capability to know what, who, where, when and how much...and share that across the entire value chain.’

‘The transition is an important step towards digitally transforming bunker supply chains, moving from paper documentation and manual processes,’ continued Jones. ‘That said, with all its attendant benefits there are considerations and risks to manage too.’

Cybersecurity and potential new kinds of fraud risks are the obvious risks, but there are other barriers to overcome, such as cost and the issues of technical implementation. However, seen as part of a wider alignment of technical advancements, then eBDNs seem an obvious and important step.’

And finally, IWSA’s **Gavin Allwright** believed it will be important to draw all these initiatives together as ‘increased digitalisation, transparency and standardisation are all critically important as we move forward along the decarbonisation pathway’.

eBDNs: ‘Bunker procurement has been a traditionally cumbersome process, burdened by manual documentation. Digitalising the bunker delivery process with mandatory eBDNs will help to solve several critical challenges in the industry and ultimately help deliver more streamlined and efficient operations which will benefit both the buyers and the suppliers.’

‘The eBDN has the potential to further accelerate the digitalisation of the bunker value chain and be the first proof of concept for digital transfer of transaction and delivery information between buyers and suppliers.’

‘One key problem tackled by eBDNs is the slow delivery of documentation between bunker suppliers, banks, and financial institutions. Digitalisation will enable swift and secure verification of fuel quantities purchased, eliminating delays and potential errors with paper-based processes to ensure smoother transactions.’

‘Automation and digitalisation will also enhance the productivity of crew by minimising data entry and reducing their administrative burden. Finally, by eliminating the need for millions of paper forms

The rest is politics

In the final section of our ship.energy survey, our respondents consider how politics and global conflict are impacting shipping and bunkering

Political and military conflicts have loomed large over the global economy over the past few years. News about the ebb and flow of the conflict in Ukraine will occasionally spark a change in oil prices, but for the most part it seems that the sanctions on Russia and the reconfiguration of oil and gas supplies have become part of 'the new normal'. Meanwhile, the conflict in the Middle East could present a serious threat to energy security – and it has already had a direct impact on the shipping industry, as attacks on vessels in the Red Sea have led to major shipping lines pausing their activities in the area and also looking at re-routing options.

Will the situation in Ukraine be a key factor for energy security and prices in 2024?

'Firstly,' began IWSA's **Gavin Allwright**, 'I can't believe that we are approaching the two-year anniversary of the invasion of Ukraine and our thoughts and best wishes go out to all of those impacted by this devastating conflict on both sides, on all of the people struggling due to the earlier energy spikes and ongoing food crisis and our thoughts are also with the brave seafarers that are in harms way too.'

'But to answer the question,' Allwright continued, 'there is a huge 'IF' here. If the situation remains the same, then this has been factored into many of the energy/pricing systems already and the mitigation of the imbalance of energy dependency in Europe has progressed quite a long way. However, conflicts rarely remain stable for long and if there is rapid escalation and tightening of energy restrictions and the closing of export loopholes from Russia then this could have a major impact on global supply and prices again, possibly not as devastating as the earlier phase but also could be longer lasting.'

'Geopolitics and war have a nasty habit of changing incredibly quickly and this is all the more reason to lower dependency on fuel and increase resilience in our fleets and diversify our power/energy base – wind propulsion cer-

tainly helps with all of these, de-risking the future with a zero-emissions, zero-cost energy source that can offset some of that volatility.'

SSSI's **Steven Jones** considered that: 'The ongoing conflict in Ukraine will indeed likely remain a significant factor influencing global energy security and oil and gas prices as long as the conflict continues. This is not least because of the ongoing issues elsewhere also. There is an intensifying impact of wider security concerns.'

'One of the factors is that the duration uncertainty of the war shows no signs of resolution. With risks of escalation then we see prolonged instability which in turn sustains market volatility. There are natural localised impacts and the Infrastructure risks in the area itself. Pipelines, refineries, and critical energy infrastructure have been, and continue to be damaged, and this disrupts regional supply chains.'

'Then there is the further problem of a chilled investment view,' Jones continued. 'Uncertainty deters needed investment in new production capacity, keeping supply tight, and with old infrastructure damaged and no appetite or capability to build new, then once more the impacts are multiplied.'

'Another issue is of course the impact beyond the geographic, and that is the hit on Russian exports. Sanctions have curtailed Russia's oil and gas exports – and the impact is a lessened supply and the full impacts still unfold constantly. While some readjustment and normalisation has occurred over the two years, the protracted nature of the conflict seems likely to extend the energy market volatility and price risks worldwide through 2024 and beyond.'

Dyonisis Diamantopoulos of Baseblue pointed out that: 'Nobody knows how this conflict will develop, or what a timeframe is for whether it de-escalates or even is resolved. For sure there is an effect due to sanctions imposed on the Russian Federation which is the 3rd in rank crude oil producer with 10% share of the world production after the US and Saudi Arabia.'

Intent Communication's **Namrata Nadkarni** reasoned that: 'As global powers ally with each other, access to energy sources will definitely be affected.'

2050 Marine Energy's **Adrian Tolson** thought the conflict would probably not be a key factor for energy prices this year as 'Ukraine risk and the impacts of this stalemate are already built into the system'. He added that: 'Even if we have "peace" Russia's future on the "outside looking in" will remain a reality for many years to come.'

MakingSense's **Kasper Søgaard**, however, flagged up that: 'Recent developments have seen Ukraine starting to target Russian energy infrastructure with drones including port infrastructure and refineries. If this continues, it could impact the Russian shipborne export of oil products, which would impact energy prices.'

Rather jumping the gun on our final Survey question, Shipping Strategy's **Mark Williams** speculated: 'If Trump wins [the US presidential election] and NATO folds, Putin may be emboldened to try to expand his war, which would shock energy markets in Europe at least. Who knows, either Trump or Putin could be dead by November!'

Will the situation in the Middle East be a key factor for energy security and prices – and the shipping industry – in 2024?

'Yes, without a doubt,' said **Allyson Browne** of HACC. 'The ongoing conflict between Israel and Hamas, Houthi rebels attacks on ships in the Red Sea and instability across the Middle East will continue to impact energy security and shipping operations, including heightened danger for crews traveling through the region.'

Steven Jones felt the Middle East situation is fast becoming a global problem. 'Perhaps even exacerbated by the impacts already being felt through the Ukraine war, the unstable situation in the Middle East further has the potential to be a significant factor affecting global energy security, oil prices, and the shipping industry.'

'There are concerns about supply disruption, and naturally a large degree of market uncertainty. These geopolitical tensions create uncertainty over production levels and OPEC's approach, influencing price volatility.'

'Then comes the real and visceral issue of maritime security,' Jones warned. 'Attacks on ships prompt rerouting and higher insurance costs. Some operators are already avoiding areas like the Red Sea, and it could be that such attacks spread further, or even target certain cargoes such as oil. The whole issue of chokepoint volatility is a real problem. Increasing risks for vessels transiting chokepoints like the Straits of Hormuz, Bab el Mandeb and Suez have an obvious impact of flows of energy and other shipping.'

'There seems to be a real flashpoint nature to the regional instability at the moment, more even than usual. The factions factor comes into play, and as nations and rebel groups jostle for position and impact, there are likely to be more complications to face.'

'The Middle East's interconnected energy, economic, and maritime security dynamics make for a significant sway factor for energy and shipping markets in the near-term. That would even be without concerns over movements through the Panama Canal, and attacks on vessels off both coasts of Africa.'

'The whole concept of energy security and the Venn diagram of concerns seems to coalesce around maritime and ship security. The protection of freedom of navigation remains a vital cornerstone of our global system and

where this is undermined, then the peace and prosperity of the world is threatened too.'

'So, while we can focus on energy security and prices, these are but a canary in the mine of global harmony. Where the world's regional wars begin joining hands, the impact is felt everywhere, the fear spreads the confusion is a contagion and there impacts grow almost exponentially.'

'Whether in Ukraine or the Middle East,' concluded Jones, 'such conflicts underscore the intricate relationship between maritime security, global peace, and the broader implications of regional conflicts on the interconnected global stage. They emphasise the significance of safeguarding vital elements like freedom of navigation for the overall well-being of the world.'

'Once again,' said **Gavin Allwright**, 'the situation in the Middle East is hot from a global perspective, and again our thoughts are with all the victims in this terrible conflict and from an industry perspective also once again the seafarers being targeted in the region.'

'If the conflict is confined to the borders of Israel and Gaza, then I would think that this conflict would have limited impact on energy security and energy prices, however as we all know it is the very real possibility of escalation to

a region wide conflict that holds very real geo-political jeopardy. The attacks on shipping in the Red Sea have already seen vessels rerouting with some knock-on effects, however this is limited disruption. Further escalation that closes the Suez approaches and draws in oil producing

nations and military powers into a region wide conflict, which are very real possibilities – these outcomes, without the need to explain further, would have profound impacts on energy prices, supply and security.'

Mark Williams was resigned: 'I can't see a return to stability in the short term (< 1 year). This is going to last, and trade and energy prices will be more volatile as a consequence.'

Dyonisis Diamantopoulos reminded us that: 'Middle Eastern countries play a big role in energy security and crude oil production, namely: Saudi Arabia is 2nd in crude oil production as per above source, Iraq 5th in rank, UAE 7th in rank, Iran 8th in rank, Kuwait 9th in rank. Therefore, any turmoil that could disrupt crude oil flow in areas (besides Iran that is already sanctioned) could threaten world energy security and of course affect shipping and routes especially for the tanker market and crude oil tankers like Aframax, Suezmax, and VLCCS.'

Some of our respondents focused on how shipping companies have been rerouting their vessels to avoid attacks.

'Due to the proximity of the conflict to the Suez Canal, one of the world major transport routes,' said Idwal's **John Nicholson**, 'it is inevitable that this will have some knock-on effect on tanker trade through the area with diversions being taken around the Cape, with any extra costs ultimately being passed onto the end consumer.'

Monjasa's **Almanda Terese Molter** said: 'Rerouting around Africa will have an impact on supply/demand functions in the West Africa region and will pose logistical bottlenecks and increased prices on bunkers. Ultimately, these developments may very well end up affecting global consumers and overall inflation levels.'

Kasper Søgaard warned of the dangers of escalation: 'The Houthi attacks on shipping in the Red Sea are already impacting maritime transport and there is a substantial risk of the conflict spreading and starting to involve more state actors like Iran directly, which could really impact shipping and the energy market.'

And finally, Smart Green Shipping's **Diane Gilpin** pointed out the conflict has again shown the need to develop new energy sources which are both cleaner and more widely available. 'In times of conflict,' she observed, 'it pays to be as self-sufficient as possible. To be able to operate without dependency on external energy providers is a strategic advantage.'

And for our final Survey question we noted how, over the past few years, there does appear to have been a greater degree of polarisation in politics, with governments swinging between extremes and this trend could come to a head in 2024, when elec-



tions are scheduled, or likely to occur, in many key countries around the world.

Will the upcoming elections and possible changes of government in some countries have an impact on the global effort on tackling climate change – and, by extension, shipping's energy transition?

Dyonisis Diamantopoulos answered: 'Indeed, new governments could bring changes to policies and ways of addressing different issues from healthcare to the environmental agenda. Such is the case also for the United Kingdom. We are observing a prime ministerial candidate, Right Honorable Sir Keir Starmer, who is a green activist to his core. This is not just plain talk: Mr. Starmer is a pescatarian who gave up meat 25 years ago as a "matter of principle" because it "wasn't the right thing for the body and the planet" (his words). He gained his first serious media attention at the start of the 1990s as a young, idealistic barrister, defending – for free – two environmental activists sued for libel by McDonalds. In case he succeeds in being elected one would have to expect the green agenda to be high in the new government's priorities.'

'As far as the US elections are concerned,' continued Diamantopoulos, 'there could be different trajectories of policies as we have seen in the past. For example, the environmental policies of Pres. Donald Trump were vastly different from the ones of Pres. Barak Obama – with the first focusing on energy independence and the latter in reduction of carbon emissions. As also in the matter of elections and such proceedings we cannot be sure on outcomes especially when US elections are only coming November 2024 and UK election is expected to be held in the second half of 2024 and must be held no later than 28 January 2025.'

Steven Jones agreed that: 'Elections and changes in government leadership within influential countries like the UK and the United States can indeed have a substantial impact on global efforts to address climate change, including the shipping industry's energy transition.'

'Political shifts often result in changes in policies, priorities, and international commitments related to environmental issues, including climate change mitigation and sustainability initiatives.'

'For instance, a change in government may lead to alterations in the level of commitment to international agreements like the Paris Agreement, affecting the overall trajectory of global climate efforts. It can also impact funding allocation, research and development initiatives, and regulatory

frameworks that guide industries like shipping towards more sustainable practices.'

'Therefore, elections and changes in government leadership in countries with significant global influence can indeed shape the direction and pace of the global effort on climate change. These shifts can directly impact policies and initiatives related to the shipping industry's energy transition, influencing regulations, investments, technological advancements, and collaborative efforts to reduce emissions and promote sustainability within maritime transport.'

'Rerouting around Africa will have an impact on supply/demand functions in the West Africa region and will pose logistical bottlenecks and increased prices on bunkers'

Almanda Terese Molter, Monjasa

'It is essential to monitor and assess how changes in government leadership translate into shifts in climate policies and their implications for global climate action, including the maritime transition. Political will and policy frameworks play a pivotal role in steering the trajectory of climate change efforts, and shifts in leadership can significantly impact the momentum and direction of these efforts.'

'Sadly,' Jones concluded, 'it often seems that there is an eagerness in some parts to use climate policy as a form of culture war, setting voter against voter as those eager for power seek to fuel anger within a populace to translate that engagement into electoral support.'

Namrata Nadkarni was optimistic. 'Policy and public funding are major levers for change and relationships between the maritime sector and new political leaders will need to be built. That said, this could also be a good thing for maritime as our sector – and particularly our commitment to a Maritime Just Transition – is a large creator of good jobs, meaning that newly elected leaders may be supportive of shipping's efforts to transition away from fossil fuels.'

However, **Kasper Søgaard** warned that our divisive global politics could stymie progress on a harmonised energy transition. 'Governments are critical in the energy transition as regulation will be needed to make shipping decarbonisation commercially viable,' he maintained. 'An orderly energy transition for shipping will require global or near global-regulation preferably adopted through the IMO. A Trump presidency, a potential US withdrawal from the Paris agreement and a

lack of US support for the ambitions of the revised IMO GHG strategy could be a serious blow to the prospects of an IMO agreement. This could lead to a fragmented regulatory landscape as other actors like the EU keep pushing for decarbonisation to the detriment of the maritime industry, the efforts to limit climate change and to developing countries.'

Almanda Terese Molter considered that: 'Possible changes in governments, in particular that in the US and also upcoming parliamentary elections in the European Union, can have major implications for current pro-

gress on the energy transition in regional and global economies. It is paramount that these elections will not reverse climate change progress. This could potentially domino-effect to specific industries, including shipping, if the proactive political momentum is lost. For instance, legislative frameworks within the Fit for 55, many of these will be up for review in the next election period, such as the FuelEU Maritime set to be reviewed in 2027.'

With all this in mind, **Allyson Browne** called on climate action leaders to stand firm and keep the transition on track. 'Political shifts in key countries will undoubtedly impact the trajectory of global action on climate change and resultantly on shipping's energy transition,' she said. 'The approach of major global powers to international collaboration on climate issues can either foster a unified global response to climate change or lead to fragmented, disjointed and ineffective efforts. This shipping industry, being inherently international, requires coordinated global policies for effective environmental regulation. This is precisely why the IMO was established. Changes in political leadership in influential countries can therefore either strengthen or weaken the collective global response to maritime environmental challenges and the actions it takes. The IMO has a mighty task ahead of it – to uphold the commitments made at MEPC 80 and to deliver on policies that will put the shipping industry on a path towards decarbonisation within planetary boundaries.'

Birketts' **Nicholas Woo** was optimistic that: 'The movement [to decarbonisation] has gained too much momentum to go into reverse

or even be slowed down.’ Drew Marine’s **Albert Leyson** agreed, saying: ‘I don’t think the momentum that the marine industry has invested into shipping’s energy transition could possibly change course regardless of who wins the White House come November.’

Gavin Allwright also felt that winds of change were blowing too strongly to be calmed. ‘Changes in government direction can obviously affect the further ratcheting up of climate policy/ambition,’ Allwright said. ‘However, I think COP28 clearly demonstrated, at least in shipping, that a set of guidelines, principles and structures are in place that are enough for many stakeholders in the industry to continue with the investment in the transition process and even move ahead of the policy curve.’

‘Could the US, EU, UK and other elections deliver results that could dampen this?’ Allwright asked. ‘Yes, of course they could. Would they result in reversing some of the regulations? That is possible – but would industry then step back and explain to their customers that emissions and climate change is less concerning to them? Of course some would, but many are increasingly aligned with the transition track.’

‘One question is: are we sufficiently embracing the urgency and depth of change that is required? Here we could easily argue that we need to move quicker and deeper and here politics can certainly drag and degrade activity. Any slowing of the transition and commitments to funding will be particularly impactful to the periphery of the global system, i.e. LDCs and SIDS where the costs and challenges of climate change are amplified, and we must be very mindful of these issues.’

‘From a wind perspective,’ Allwright said, ‘our members have brought a resilient determination to developing wind propulsion systems to the last decade, weathering scepticism in the market, huge drops in fuel prices, pandemics, political upheaval, logistics crises and so much more. They are still here and determined to deliver their solutions to the market so I think from a resilience point of view, they are well placed to weather the political uncertainties facing us in the coming years too.’

Opportunity Green’s **Blánaid Sheeran** was another who believed that: ‘No matter the result of the upcoming elections, progress cannot be halted at any level. The momentum is growing with numerous different initiatives and declarations: at the 2023 Paris Summit, 22 countries supported taxing shipping emissions; at the African Climate Summit (September 2023) various Heads of State and Government from the African Union signed the Nairobi Declaration, which included a

call for a “global carbon taxation regime including a carbon tax on fossil fuel trade, maritime transport [...]”; and in the run up to COP28, we saw Antigua and Barbuda, Barbados, France, Kenya, and Spain jointly launch a new taskforce on international taxation, including on maritime transport. Governments may change but the direction of travel is 100% clear: towards a just and equitable decarbonisation of shipping.’

Sofia Esquivel Elizondo and **Panos Spiliotis** of Environment Defense Fund also felt there was no going back. ‘Under the Paris Agreement,’ they reminded us, ‘195 countries committed to the goal of net zero emissions and economy wide decarbonisation by 2050. Since its signing in 2015, our toolbox has been enhanced as renewable energy technologies have further improved and fallen in deployment cost. Furthermore, surveys of citizens in many countries, including the U.S. and the UK, find them supportive of climate action in great numbers. Although political shifts and changes of government can reconfigure the specifics of each country’s green transition, the overall shift to net-zero economies is well underway and cannot be undone.’

Mark Williams was not so sure. ‘If Trump and the Tories win [in the UK],’ he warned, ‘expect oil and gas exploration to continue / grow and global agreements to be undermined. Already, governments and international bodies are failing in their duty to reflect what most people know and agree on as individuals. This is a symptom of the primary geopolitical trend of the 21st century, i.e. the loss of influence of supranational systems of governance and law, to be replaced by nationalism, bilateralism, alliances and club deals – a world which looks politically more like that of the 19th century.’

1945. During Donald Trump’s presidency, and in spite of a constitutional ban on interstate compacts, several US states agreed between themselves new regulations on issues like air quality and transport.

‘States, corporate actors and individuals still have a role to play, regardless of the farcical decadence of the COP process and lack of a global agreement on a terminal date for fossil fuel consumption. China installs more renewable power per year than the rest of the world combined and sells a third of the world’s electric vehicles domestically, as well as building coal fired electricity generation. Its CO₂ emissions might peak by 2030 due to local air quality regulations, not international environmental treaties. Due to government tax policies, 99% of cars sold in Norway are now electric.’

‘The EU has not waited for COP to include shipping in its emissions trading system or to implement its carbon border adjustment mechanism. Chinese companies have responded by moving manufacturing closer to Europe, using renewable energy in Morocco to power auto and battery factories directed explicitly at the EU market. This is just the start, I believe, of a Chinese response to environmental and demographic trends which disfavour its further growth as a manufacturing and exporting hub.’

There’s a lot to digest and ponder on there! But we will close this year’s Survey with some thoughts from **Adrian Tolson**, who was concerned about the rise of divisive political players – but still had faith in the basic Democratic principle that ‘You can’t fool all of the people, all of the time’ and concluded: ‘I think if you don’t believe the evidence of your eyes and live in a state of denial, then you might wish it [climate

‘The Middle East’s interconnected energy, economic, and maritime security dynamics make for a significant sway factor for energy and shipping markets in the near-term’

Steven Jones, Sustainable Shipping Initiative

‘When governments fail to govern, or fail entirely, other institutions rise to fill the void. Between 2018 and 2020, the country of Belgium managed for 652 days without any political party being able to form a national government. Italy has managed for decades with governments which lasted an average of 13 months. Georgia Meloni’s administration is Italy’s 68th since

change] all away in the short term by supporting a politician or party that promises a return to the mythological good old days. But the evidence is clear and the *majority* is not in denial. Capitalism will follow what the market dictates and so dealing with climate change will be both the popular agenda and the financially best thing to do. Shipping will follow this direction.’