

## EMISSIONS MANAGEMENT

# Uncharted waters



Artist's impression of a dual-fuelled LNG-powered shuttle tanker  
Photo: AET

For decades now, ship owners around the world have largely relied on intermediate or heavy fuel oil to power the main engines of their oceangoing ships. Widely available and relatively cheap, these fuel oils have also been used by refiners to provide an outlet for the sulphur generated through the processing of sour crude oils.

So, when the International Maritime Organisation (IMO) decided in 2008 to put a cap on the level of sulphur oxide (SO<sub>x</sub>) emissions that would be permitted, there was consternation if not outright disbelief. Indeed, there were many who doubted whether the 2020 deadline set by IMO could be met. IMO had left the door open slightly, saying it would review the date in light of the likely availability of low-sulphur fuel, only to slam it shut in 2016 when it confirmed the 2020 date.

Ship operators, therefore, now have two main options to meet the sulphur emissions restrictions, which take effect promptly on 1 January 2020. They can either switch to burning low-sulphur fuel oil, which will inevitably be more expensive, not only as a result of the extra processing required but also because of its comparative scarcity, at least at the moment; or they can install exhaust gas scrubbers. Burning marine gasoil or

**Tanker owners are being asked to prepare for a future they cannot yet foresee as the IMO strengthens its environmental protection rules, writes Peter Mackay.**

other middle distillates, currently used primarily for auxiliary engines, is another option.

The choice is a simple one of economics – will the cost of installing a scrubber (including the time a ship is not working and the cost of drydocking, in addition to the cost of the equipment) be recouped by means of being able to use cheaper high-sulphur fuel oil over the long term? That is not a simple calculation, particularly if those owners who choose to use costlier low-sulphur fuel oil or gasoil can retrieve that expense through bunker fuel escalation clauses in charter parties.

In the immediate term, two developments have affected that calculation further. Firstly, it emerged in mid-October 2019 that around 4.5mn tonnes of low-sulphur fuel oil was in floating storage in the Singapore/Malaysia region, with more sweet crudes also in storage, indicating that low-sulphur material may not be in such short supply as had been feared. Secondly, increasing US sanctions on Chinese shipping

companies had effectively taken a lot of tonnage out of the open market, resulting in a spike in tanker freight rates during October. As a result, according to IHS Markit, a number of owners decided to delay putting their ships into drydock to have scrubbers fitted, preferring instead to reap the benefits of the booming earnings that will in effect help pay for scrubber installation in due course.

## On to 2030

If ship owners have faced some tricky decisions to meet the IMO 2020 rules, there is worse to come. IMO has committed to meeting the UN Sustainable Development Goals, adopted in 2015, that will in part call for a reduction in carbon dioxide (CO<sub>2</sub>) emissions by 2030. That deadline is only 10 years away and, given that most oceangoing ships are designed and constructed to have a working life of 20 or 25 years, owners placing orders for new ships today have to take future regulation into account – even though it is not clear what form that regulation will take.

What is certain, however, is that IMO 2030 will require the use of fuels with a much lower carbon intensity. That is likely to rule out the continued use of fuel oils, whether low-sulphur or not, and points instead to alternative fuels.

Some owners have used the



impetus provided by the IMO 2020 deadline to investigate such fuels already. One obvious choice is LNG, as this has been successfully used by LNG carriers for decades. During the transport of LNG as cargo, a certain proportion boils off in the form of methane and this can be used to supplement bunker fuel supplied to the main engine. This meant that LNG carriers were for a long time wedded to steam turbine engines, which had generally been replaced in the rest of the merchant fleet – although over the past 20 years owners have been able to take advantage of innovations in main propulsion machinery, especially in areas of hybrid power technology.

Nevertheless, for other ships, the use of LNG presents problems. It is, for instance, extremely expensive (and quite often simply impossible) to install the fuel tanks and piping needed to handle a cryogenic liquid and to deliver regasified methane to the main engine.

Furthermore, despite the recent increase in the number of mainline LNG production and receiving terminals, and investment in small-scale facilities, LNG is not available everywhere.

LNG has, however, found favour in certain locations and some maritime sectors, particularly where vessels are working a regular trade that allows them to bunker in one port, or where there is mileage in being able to promote the ships themselves as being particularly environmentally friendly.

As such, for instance, ship owners in Scandinavia have been investing in LNG-fuelled newbuildings to serve remote locations, whether as ferries or for the delivery of fuels and other products. Similarly, an LNG bunkering and small-scale distribution point has been established in Jacksonville, Florida, where TOTE Maritime and Crowley Maritime are bunkering vessels built specifically to handle freight and passenger traffic to Puerto Rico and elsewhere in the Caribbean.

#### Other liquid fuels

Another established lower-carbon alternative fuel is methanol, although again this has so far been used only by tankers carrying methanol as cargo. Methanol is highly sensitive to contamination by two things – water and salt, which are in plentiful supply during a sea voyage. As a result, methanol carriers are almost always dedicated to that product so as to obviate the need for tank cleaning.



Concept design for a hydrogen carrier  
Photo: Kawasaki Heavy Industries

Experience with the use of methanol as a marine fuel is therefore very limited, with only the specialist methanol tanker operators such as Mitsui OSK Lines and Waterfront Shipping, a wholly owned subsidiary of Methanex Corporation, having run purely methanol-fuelled tankers for any length of time. In addition, methanol is more toxic than other fuels and also has a comparatively low energy intensity.

On the other hand, the use of methanol as a fuel in other applications (such as motor racing) does have a track record, and methanol is relatively cheap and easy to produce through a number of channels. These include the synthesis of CO<sub>2</sub> and hydrogen (H<sub>2</sub>), which might in due course provide an outlet for carbon capture and storage (CCS) projects.

There has not yet been as much interest in methanol as a fuel as there has been in LNG, although in October 2019, Proman Shipping, which currently manages 12 chemical tankers on behalf of its parent group, announced a joint venture with Stena Bulk that will initially focus on the use of methanol as a fuel for two IMOIMAX chemical tankers.

The third lower-carbon alternative currently under discussion is LPG, although this too is relatively untested. In 2017, Dorian LPG, one of the largest operators of very large gas carriers (VLGCs), sought the help of ABS to evaluate the use of LPG as a marine fuel. In May 2018 it reached agreement with Hyundai Global Service to undertake research into the possible upgrading of its fleet so as to be able to use LPG in its ships' engines. There are technical issues relating to burning LPG in existing engines that need to be resolved before it can be regarded as a viable option, although ABS and others are continuing to work on the issue.

#### Moving to zero

Looking past 2030, IMO is already considering how to move towards a zero-emission future, with 2050 identified as a target date in line with other UN initiatives. How

that is to be achieved is not clear at present, although a decarbonised shipping industry will, like other transport and industrial sectors, most likely have to rely on hydrogen and, potentially, ammonia alongside sustainably produced electricity. As yet the technologies that will be needed are not tested at the scale at which they will have to operate, but there are some basic assumptions.

Hydrogen can be used either as a fuel directly in an engine or in a fuel cell to produce electricity. In either case, a new approach to vessel and engine design will be needed. In September 2019 the Port of Antwerp announced it had ordered a hydrogen-powered harbour tug that will burn hydrogen in combination with diesel. The tug is being built by local firm Compagnie Maritime Belge (CMB), which in 2017 launched a passenger catamaran powered by a similar system that is being used as a ferry for its own staff on the river in Antwerp.

Hydrogen fuel cells could also potentially open another route towards small, electric-powered ships or hybrid vessels. (See *Petroleum Review*, November 2019).

The shipping industry does seem to be taking the challenge of decarbonisation seriously. Indeed, in September 2019 the Global Maritime Forum announced the 'Getting to Zero Coalition' ahead of the UN Climate Action Summit in New York. More than 50 companies are participating in the coalition, including the leading classification societies and ship operators, each committing to support transition to zero-emission vessels (ZEVs). The ambition is to have commercially viable ZEVs operating along deepsea trade routes by 2030, supported by the necessary infrastructure for scalable zero carbon energy sources, including production, distribution, storage and bunkering, in order to meet the IMO's target of reducing greenhouse gas emissions (GHG) from international shipping by 50% by 2050 compared to 2008.

'The greatest challenge of our generation – and the next – will be the decarbonisation of the shipping industry,' said Christopher J Wiernicki, ABS Chairman, President and CEO, at the time of the Coalition's launch. Being able to meet that challenge will take multi-disciplinary collaboration and a willingness to be open to new ideas and new technologies. The only certainty is that the tankers of the mid-21st century will look and behave very differently from those of today. ●