



DECONSTRUCTING DECARBONISATION: THE PUSH TOWARDS NET ZERO

Decarbonisation remains a significant challenge for the global shipping industry. While we are starting to see some progress, there is a requirement for a keener focus on action and investment to meet stringent emissions targets and 2050 net zero goals.

In this article, we consider the key operational challenges with regards to alternative fuels and seafarer training.



THE REGULATORY IMPERATIVE

A range of measures and laws are coming into force over the next few years with an aim to regulate and reduce shipping's carbon footprint.

To help develop a clean fuel pathway, current and new regulatory incentives focus on the Carbon Intensity Indicator (CII), EU Emissions Trading System (EU ETS) and the FuelEU Maritime initiative which comes into force in 2025.

Positive steps have been made via the CII, the annual measure of the carbon intensity of a ship's operations. However, this short term framework is changing, as outlined at the March meeting of the Maritime Environment Protection Committee which included the Fuel GHGI (Greenhouse Gas Indicator). Life Cycle Assessments (LCA) are ongoing to develop robust life cycle GHG/carbon intensity guidelines for all types of fuels, i.e. well-to-wake and tank-to-wake emissions.

Another more definitive, regional driving force is the EU, with the EU Emissions Trading System (ETS) introduced from 1st January 2024, and the FuelEU Maritime initiative being introduced in 2025 for ships making voyages to and from EU ports. The EU carbon tax will be a significant milestone as the fuel ship owners consume will be calculated using GHGI (total greenhouse gas emissions).

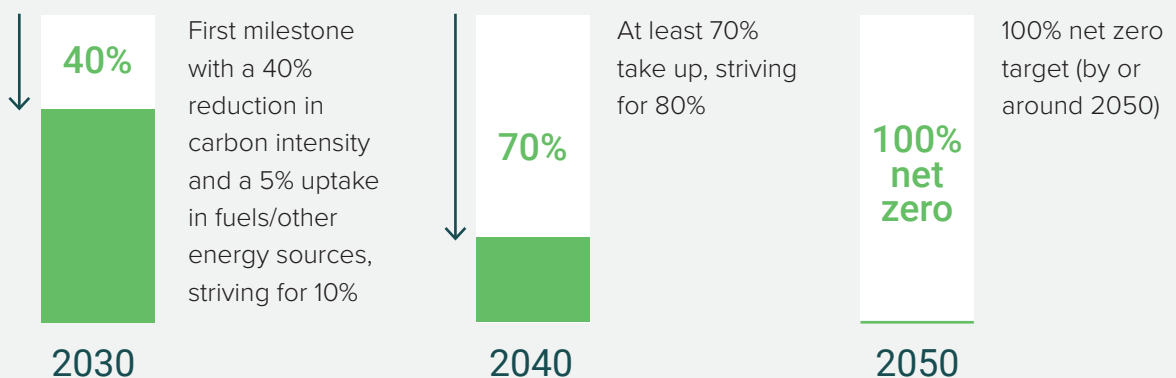
When this kicks in, we expect to see a bigger drive towards green fuels well to wake emissions, in turn paving the way for better, stronger alignment in terms of vessel investment, production capacity, infrastructure and regulatory requirements.

In the CII era, some major ship owners are spearheading the development of new builds with dual fuel engines. According to a year-end shipbuilding review from Clarksons, nearly half of all new build tonnage on the world's shipyard order books is ready for alternative fuels.

Naturally, a ship that runs on more than one fuel has its own set of challenges and needs to be designed from the outset to accommodate dual fuel requirements.

As an example, there needs to be space for two separate fuel tanks, associated fuel lines, conditioning systems to control pressure and temperature and filters for two different fuels.

THE INTERNATIONAL MARITIME ORGANIZATION (IMO) TARGETS:



Source: RESOLUTION MEPC.377(80) (adopted on 7 July 2023)



GLOBAL INFRASTRUCTURE IS AN IMPERATIVE

In agreeing a dominant set of viable fuel pathways, many of the main actors are waiting for someone else to make the first move before making a decisive commitment.

An absence of bunkering facilities is one hurdle in the decision making process. Realistically, any vessel powered by fuel oil can visit virtually any port in the world and bunker with sufficient supplies (not necessarily what they want but most marine diesel engines are pretty accommodating) to get them on their way.

That is not the case with LNG and other potential fuels which presents a significant problem. While multiple engines labelled “dual fuel” are available, vessels often do not have the capability to bunker and store multiple fuels. Of those that do have the capability, vessels are often still using fuel oils due to a shortage in the necessary bunkering facilities.

For electric power, there are very few locations for vessels to cold iron or for battery powered vessels to recharge.

Finally, we don't have developed rules and regulations for novel fuels, another factor that is impacting the speed of adoption. The regulations surrounding steam plants and the commercialisation of internal combustion engines were developed over a century and involved a period of trial and error. Starting from scratch requires significant investment and safety has to be paramount.

SAFEGUARDING SEAFARERS

The operational practicalities of new fuels presents yet another set of risks and challenges affecting all the people who work on the frontline of the marine industry, and there is already a widely reported problem with seafarer recruitment and retention.

The re-training of crew with regards to ship safety management systems, firefighting skills and marine fuel management procedures (for engineers and technical staff) is paramount, requiring yet another step change in both industry provision and mindset.

Even if you can find the right people, you cannot necessarily find the courses or training providers. Many potential new fuel options are supported by ancillary electrical equipment. Electro-Technical Officers are in short supply. Clean inert gas systems and cryogenic systems all require an upskilling in both maintenance and operations.

INFRASTRUCTURE. SHIPS. PEOPLE.

As we enter the next stage in the transition roadmap, TMC Marine is well placed to advise on a broad range of aspects in terms of expertise and guidance regards technology and clean shipping project management. This includes:



EXISTING SHIPS

Existing ships, including carbon reduction / capture technology, sails, batteries, cold ironing and retrofit projects.



NEW SHIPS

The development and design of new fuel ready vessels to minimise future retrofits; fuel types and what kind of global investment there is with regards to infrastructure. Our analysis will consider what is being consumed, tried and tested.



BUNKERING DESIGN, PLANS AND PROCEDURES

The majority of proposed alternative fuels provide less energy than heavy fuel oil (HFO), which affects the requirement for more bunkering or bigger tanks for storage. Bunker tank locations, type, size, piping design and installation, ventilation, automated warnings, alarms and shutdowns are all factors to be considered.



FUEL MANAGEMENT

The types of fuel being suggested can require cooling, pressurising, inerting etc. This requires ancillary equipment for fuel management not typically seen on all vessels.



EMERGENCY RESPONSE

The emergence of alternative fuels will require a new set of international spill response procedures to mitigate environmental impact and claims.



TRAINING

The upskilling of seafarers across the board.

THE PROS AND CONS OF ALTERNATIVE FUELS

We believe the simplest alternative fuel to manage will be the outlier for now, but alternative fuels will be coming.

AMMONIA

Toxic	✗
Different fuel management and ventilation requirements	✓
Ship design changes are required in case of any leaks	✗
Multiple sensor installations	✗
Fuel system installation costs increased	✗
Firefighting techniques. Ammonia is less flammable than other fuels and dissolves in water quite effectively, but in ship compartments water deluge will cause issues, including flammability in air 4 -75% mix wide range.	✓
Similar system design as LPG fuel systems, accommodating future ship retrofits from gas to ammonia	✓

HYDROGEN

Under development	
Highly flammable. Hydrogen fires are invisible to the naked eye	✗
Risk of asphyxiation in confined spaces	✗
Undetectable, odourless, colourless and tasteless, unlike LNG where artificial smells are introduced for detection, these artificial smells don't travel with hydrogen	✗
Carriage in liquid form cryogenic systems (-253 liquid form). Storage in pressurised cryogenic tanks or at ambient temperature in pressurised tanks	✓
Fuel management spaces and ventilation requirements	✗
Ship design changes in case of any leaks; ventilation	✗
Multiple sensor installations	✗
Fuel system installation costs increased	✗

METHANOL

Toxic	✗
Green methanol is expensive with very little currently being produced well to wake	✗
It has been used as a fuel for over a decade on smaller vessels	✓
2.5 times storage space required compared to conventional ships	✗
In liquid form at atmospheric pressure, but has a low flash point	✓
There is a ramping up in availability and bunkering locations globally	✓
Dissolves in water	✓
Fuel management on ships is easier to manage than other proposed alternative fuels	✓



THE TMC TEAM

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