MARINE INNOVATION

PAYAM DARYA

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A MAJOR SHAKE-UP FOR SHIPPING INDUSTRY

- Sulphur limit; stimulate innovation and enhance efforts to energy efficiency
- Bumps ahead for maritime transportation
- Maritime transport systems and the 4th industrial revolution in the third millennium


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A NEW ERA IN SHIPPING INDUSTRY HAS DAWN

By: Fatemeh Moonesan
Editor-in-Chief

Once, we believed that we are on the brink of the fourth industrial revolution, but, at the present time, we are witnessing that the fourth industrial revolution has penetrated each and every sector. The concept of Industry 4.0 is described as “an increasing digitization of the entire value chain and interconnection of people, objects and systems through real time data exchange”, according to Fabian Hecklau. Industry 4.0 is led by full force emergence of technologies which are blurring traditional boundaries. It is induced by the emerging breakthrough technologies in the fields such as; artificial intelligence (AI), 3D printing, nanotechnology, robotics, quantum computing, genetics and biotechnology, the Internet of Things (IoT), fifth-generation wireless technologies (5G) and energy supply and consumption.

Without a shadow of a doubt, the fourth industrial revolution will reshape the maritime industry. With the emergence of technologies like 3D printers, we would experience a downward trend in the trade of finished and semi-finished goods, while an upward trend in the trade of raw materials. Therefore, in the light of new technologies, it is expected that the patterns and amount of demand for shipping will undergo tremendous change.

The considerable role of fourth industrial revolution on future skills is undeniable. It triggers the necessities of highly qualified human resources. Regarding the shipping industry, the seafarers of the future are required to be highly skilled and highly trained in both traditional maritime tasks and fourth industrial revolution technology operation.

SULPHUR LIMIT; STIMULATE INNOVATION AND ENHANCE EFFORTS TO ENERGY EFFICIENCY

Concerns have been raised that the shift to low sulphur fuel may be associated with ambiguity about the safety and operational issues of compliant fuels as well as their shortage after January 1, 2020. If a ship, despite its best efforts to obtain compliant fuel oil, be unable to obtain compliant fuel, what steps should be taken to mitigate the risk of non-compliance. In order to find the answers to these questions, Marine Innovation magazine has spoken to Dr. Edmund Hughes, the head of Air Pollution and Energy Efficiency in the Marine Environment Division of the International Maritime Organization (IMO).

Dr. Edmund Hughes, the head of Air Pollution and Energy Efficiency in the Marine Environment Division of IMO

What information should be provided by fuel suppliers to allow ship operators to identify and manage potential fuel-related safety and operational issues?

MAROL Annex VI includes Regulation 18 on fuel oil availability and quality. It says that fuel oil should be free from inorganic acid; not include any added substance or chemical waste that jeopardizes the safety of ships or adversely affects the performance of the machinery, or is harmful to personnel, or contributes overall to additional air pollution.

Details of fuel oil supplied for combustion purposes delivered to and used on board should be provided in the Bunker Delivery Note (BDN) and there should be a representative sample of the fuel oil delivered.

The minimum information required to be included in the BDN is set out appendix V of MARPOL Annex VI as follows:

1 Name and IMO Number of receiving ship
2 Port
3 Date of commencement of delivery
4 Name, address, and telephone number of marine fuel oil supplier
5 Product name(s)
6 Quantity in metric tons
7 Density at 15° C (kg/m^3) *
8 Sulphur content (%m/m) **
9 A declaration signed and certified by the fuel oil supplier's representative that the fuel oil supplied is in conformity with regulation 18.3 of this Annex and that the sulphur content of the fuel oil supplied does not exceed:
- the limit value given by regulation 14.1 of this Annex;
- the limit value given by regulation 14.4 of this Annex; or
- the purchaser's specified limit value of _____ (% m/m), as completed by the fuel oil supplier's representative and on the basis of the purchaser's notification that the fuel oil is intended to be used:

1- In combination with an equivalent means of compliance in accordance with regulation 4 of this Annex; or
2- is subject to a relevant exemption for a ship to conduct trials for sulphur oxides emission reduction and control technology research in accordance with regulation 3.2 of

this Annex.

The declaration shall be completed by the fuel oil supplier's representative by marking the applicable box(es) with a cross (x).

* Fuel oil shall be tested in accordance with ISO 3675:1998 or ISO 12185:1996.

** Fuel oil shall be tested in accordance with ISO 8754:2003.

IMO has issued *Guidance on best practice for fuel oil purchasers/ users for assuring the quality of fuel oil used on board ship*s (MEPC.1/ Circ.875), intended to assist fuel oil purchasers/users in assuring the quality of fuel oil delivered to, and used on board ships, with respect to both compliance with the MARPOL requirements and the safe and efficient operation of the ship.

IMO has also issued *Guidance on ship implementation planning (issued November 2018), which covers* risk assessment and mitigation plan (impact of new fuels); fuel oil system modifications and tank cleaning (if needed); fuel oil capacity and segregation capability; procurement of compliant fuel; fuel oil changeover plan (conventional residual fuel oils to 0.50% sulphur compliant fuel oil); and documentation and reporting.

There should be risk assessment – as part of the safety management system when taking on and managing new fuel blends

There should be risk assessment – as part of the safety management system - when taking on and managing new fuel blends. Ships are advised to assess potential impact on machinery systems with the use of distillates and fuel oil blends and prepare ships in consultation with chief engineers, equipment manufacturers and suppliers. The ship tank configuration and fuel system may require adjustments. A fully segregated fuel system for distillate fuels and blended fuels is recommended because they may require special attention. Ship tank configuration and segregated fuel system will also allow for better management of potentially incompatible fuels.

Member States are required to upload a FONAR to an online

IMO Member States have agreed a standardised FONAR for ships to use to report non-availability. But this should be considered as a last resort

system for the IMO, could you please explain? Do you think using FONAR is an appropriate action to facilitate compliance with the fuel regulation?

When a ship is unable to obtain compliant fuel oil, it can provide evidence, in the form of a fuel oil non-availability report (FONAR). This report is to be sent to the flag Administration and to the competent authorities in the relevant port(s) of destination in accordance with regulation 18.2.4 of MARPOL Annex VI. The report shall be sent as soon as it is determined that the ship/operator will be unable to procure compliant fuel oil and preferably before the ship leaves the port/terminal where compliant fuel cannot be obtained.

A copy of the FONAR should be kept on board for inspection for at least 36 months. The report does not need to be sent to IMO by the ship. IMO Member States have agreed a standardised FONAR for ships to use to report non-availability. But this should be considered as a last resort - taking on non-compliant fuel should only be done in exceptional circumstances due to operational and logistical difficulties associated with bringing the ship back into compliance, for example, tank cleaning.

Shipowners should remember that a FONAR is not an exemption – and they are reminded of this in the *2019 Guidelines on consistent implementation of 0.50% sulphur limit under MARPOL Annex VI,* which IMO has adopted, and which contains the format of the FONAR in appendix 1 (MEPC.320(74)).

According to regulation 18.2 of MARPOL Annex VI, it is the responsibility of the Party of the destination port, through its competent authority, "to scrutinize the information provided and take action, as appropriate".

If there is insufficiently supported and/or repeated claims of non-availability, the Party may require additional documentation and substantiation of fuel oil non-availability claims. The ship/operator may also be subject to more extensive inspections or examinations while in port.

Furthermore, if the port State control authority decides to require the ship to come back into compliance, the ship will need to procure compliant fuel oil and clean the fuel tanks and lines to ensure the compliant fuel oil is not contaminated.

Ships/operators are expected to take into account logistical conditions and/or terminal/port policies when planning bunkering. This could mean having to change berth or anchor within a port or terminal in order to obtain compliant fuel.

Ships/operators are expected to prepare as far as reasonably practicable to be able to operate on compliant fuel oils.

IMO has also adopted a carriage ban on non-compliant fuel oil, which enters into force on 1 March 2020. This is the MARPOL amend-

ment adopted in 2018 to prohibit the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship - unless the ship has an exhaust gas cleaning system ("scrubber") fitted.

The amendment is intended as an additional measure to support consistent implementation and compliance and provide a means for effective enforcement by States, particularly port State control.

The specific provision requires that fuel oil used on board ships shall not exceed 0.50% sulphur limit. The amended provision to prohibit the carriage of non-compliant fuel oil reads as follows: "The sulphur content of fuel oil used or carried for use on board a ship shall not exceed 0.50% m/m".

So, carriage of fuel oil for use on board ships will be prohibited from 1 March 2020 if the sulphur content exceeds 0.50% - unless a scrubber is fitted. (The provision does not apply to fuel oil being carried as cargo.)

What mechanism has been proposed that member states and ports will be required to supply the necessary fuel?

The IMO regulation limiting the amount of sulphur in fuel oil essentially creates a market for low sulphur fuel. Refineries are responding to that demand by producing low sulphur fuel oil blends.

IMO has issued *Guidance on best practice for fuel oil suppliers for assuring the quality of fuel oil delivered to ships* (MEPC.1/Circ.875/Add.1).

MARPOL Annex VI Regulation 18 requires each Party to take all reasonable steps to promote the availability of fuel oils that comply with the requirements and to inform IMO of the availability of compliant fuel oils in its ports and terminals. Parties to MARPOL Annex VI can inform the IMO through the MARPOL Annex VI module found in the IMO Global Integrated Shipping Information System (GISIS).

What do you think about the impacts of implementation of the 0.50% sulphur limit law on shipping industry? How do you see the future?

The sulphur limit is a positive step towards limiting the harmful impact of shipping on the environment. The new limit will have positive beneficial impact on human health and the environment. Whilst there are likely to be increased costs as the cost of better quality fuel for ships is likely to cost more, it is important that the costs of pollution from ships are reflected appropriately as increasing the cost of fuel will stimulate innovation and enhance efforts to the energy efficiency of international shipping which in turn means less fuel oil is consumed and operational costs are reduced.

The sulphur limit is just one tool in IMO's efforts to ensure a more sustainable and greener shipping industry - and in particular the decarbonisation of shipping.

In 2018, IMO Member States adopted an initial strategy for reducing GHG emissions from shipping and phasing them out entirely, as soon as possible. The strategy includes a specific linkage to the Paris Agreement, and clear levels of ambition – including at least a 50 per cent cut in emissions from the sector by 2050, compared to 2008.

Since global trade and maritime transport are expected to continue to grow in the coming years – last year 11 billion tons of cargo was carried for the first time - to achieve the specified targets, ships would have to reduce their emissions by more than 80%. The agreed reduction targets signify a tangible trajectory towards decarbonizing shipping. Therefore, zero-emission ships should begin to be built well before 2050, hopefully by the 2030s.

We also have the phasing in of the so-called D2 standard under the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004* (the BWM Convention). The treaty entered into force in 2017 and amendments to the BWM Convention adopted in April 2018 entered into force in October 2019. These amendments, among other things, brought into force a schedule for implementation. In essence, the schedule for implementation means that compliance with the D-2 standard set out in the Convention will be phased-in over time for individual ships, up to 8 September 2024. Over time, more and more ships will be compliant with the D-2 standard.

Of course, we should always remember that we are talking here about a global industry which provides a vital service to the world. Maritime transport is essential for sustainable development in the future. It provides a dependable, energy efficient and low-cost way to transport more than 80 per cent of global trade, linking peoples and communities all over the world. It facilitates commerce and helps to create prosperity, supporting the achievement of the UN Sustainable Development Goals. But for it to achieve that goal shipping itself needs to be sustainable.

IMO 2020 REGULATION AND ITS IMPACT ON THE SHIPPING

By: Reza Darban, Researcher and Consulting Engineer in Marine Technology

Abstract
IMO 2020 and new requirements will affect ship owners, refiners, and all other related parties along the marine fuel supply chain. The world will hope to see a greener environment in shipping industry, but also a serious change in global fuel supply and demand. Some players such as refiners with an already set-up infrastructure to supply compliance fuel, or marine equipment suppliers for scrubbers and LNG power plant benefit from the changes. Shipping costs are likely to increase once the regulation takes effect. [2]

Keywords: IMO2020, sulphur limit, Sox, Scrubber, compliance, implementation, MARPOL VI

1. Introduction

1-1 Legal Background

Ocean going vessels are the most efficient transport mode, but they generate a substantial amount of waste during their operation. Since marine pollution prevention convention (MARPOL) was adopted in 1973 till mid 1990's the primary concern of internal maritime organization (IMO) was on hazardous discharge prevention from vessels to sea through MARPOL Annex I to V.

In the last three decades, air pollution issues have been discussed mostly considering that shipping activities worldwide contribute to the global emissions of air pollutants that are produced as the result of human activities. IMO took steps to reduce ships' sulphur oxides (SOx) emissions with the improvement by successive operations under regulations in Annex VI of MARPOL 73/78, which

was adopted by a further Protocol in 1997 and ratified by a sufficient number of member states to enter into force on 19 May 2005.

SOx normally refer to SO2 and sometimes to SO3. It can harm the human respiratory system making breathing difficult and it is particularly serious for children, the elderly and people suffering from asthma. Moreover, high concentrations of gaseous SOx can harm plants and trees and it can cause acid rain which can harm sensitive environment. [8]

It is produced by oxidation of sulphur during engine combustion. In contrast with NOx, Sulphur in SOx is mainly from contents in fuel, barely related to the combustion process in engines.

In the beginning of the legislation process, IMO took measures to mitigate only SOx emissions from ships within coastal areas through SOx Emission Control Area (SECA), which restricts sulphur content in fuel oil at a certain level. The Baltic Sea is the first designated SECA and was followed by the North Sea including the English Channel under regulation 14 of Annex VI. It entered into force on 19 May 2006 for the Baltic Sea and 22 November 2007 for the North Sea and the English Channel. The sulphur content of any fuel oil consumed onboard ships navigating within SECA must not exceed 1.50%, while the global sulphur cap must not exceed 4.50%.

IMO emission control areas

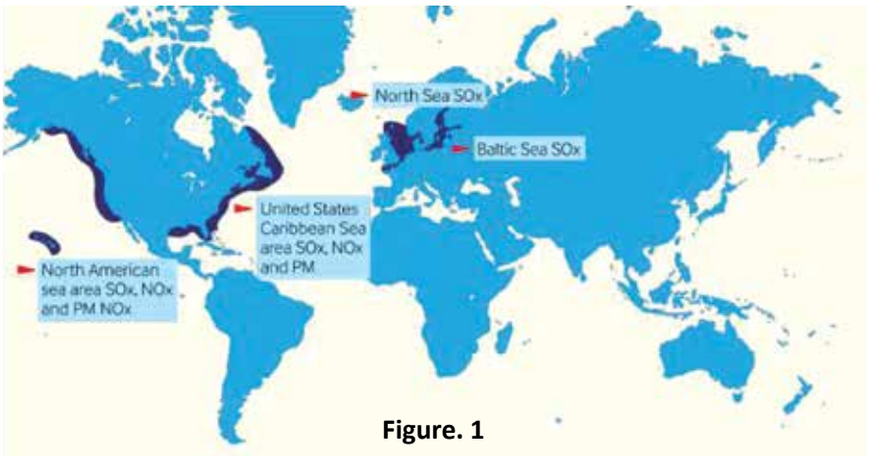


Figure. 1

In October 2008, Annex VI was amended by the MEPC at the 58th session, including a gradual decrease in the amount of SOx emissions, which entered into force on July 1, 2010 under tacit acceptance procedures. A progressive reduction in sulphur content of fuel oil to 1.00% had been effective from 1 March 2010 and to 0.10% beginning on 1 January 2015 within ECA; meanwhile the global sulphur cap had been restricted to

3.50% from 1 January 2012, then gradually to 0.50% from 1 January 2020 subject to a feasibility study by 2018 (IMO, 2008d).[3]

On October 2016, the International Maritime Organization (IMO) enacted a new regulation for sulphur content in marine fuels requiring sulphur content to be reduced from 3.5% to 0.5%. The implementation date for this change is effective January 1, 2020. This regulation is typically referred to as MARPOL VI. [4]

Shown above, Maximum allowable sulfur content in fuel oil, according to IMO requirements which are applied to all ships entering a global (all European sea areas) or Emission Control Areas (ECA). [6]

1-2 IMO 2020 (MARPOL Annex VI, regulation 14) in brief

The key IMO instrument governing sulphur dioxide emissions from vessels is MARPOL Annex VI, Regulation 14 (the "Regulation"). It provides that as of 1 January 2020, all vessels (registered with flag states that have ratified Annex VI or vessels passing through or calling at port states which have ratified Annex VI) will be subject to the following requirements:

- The limit for the sulphur content of fuel used on board a vessel operating outside one of the four Emission Control Areas (ECAs) decreases from 3.5% mm to 0.5% mm. Within the ECAs the limit remains 0.1%. (Figure. 1)
- Compliance with other operational requirements such as:

- Vessels must produce a bunker delivery note stating the sulphur content of any fuel oil stemmed;
- Vessels must carry an International Air Pollution Prevention (IAPP) certificate;
- Vessels must have onboard a written procedure for fuel oil changeover when entering/leaving an ECA; and
- Vessels must maintain a log (as prescribed by their flag state) recording adherence to the changeover procedure.

In addition, from 1 March 2020 vessels will be prohibited from carrying non-compliant fuel unless they have scrubbers fitted. [5]

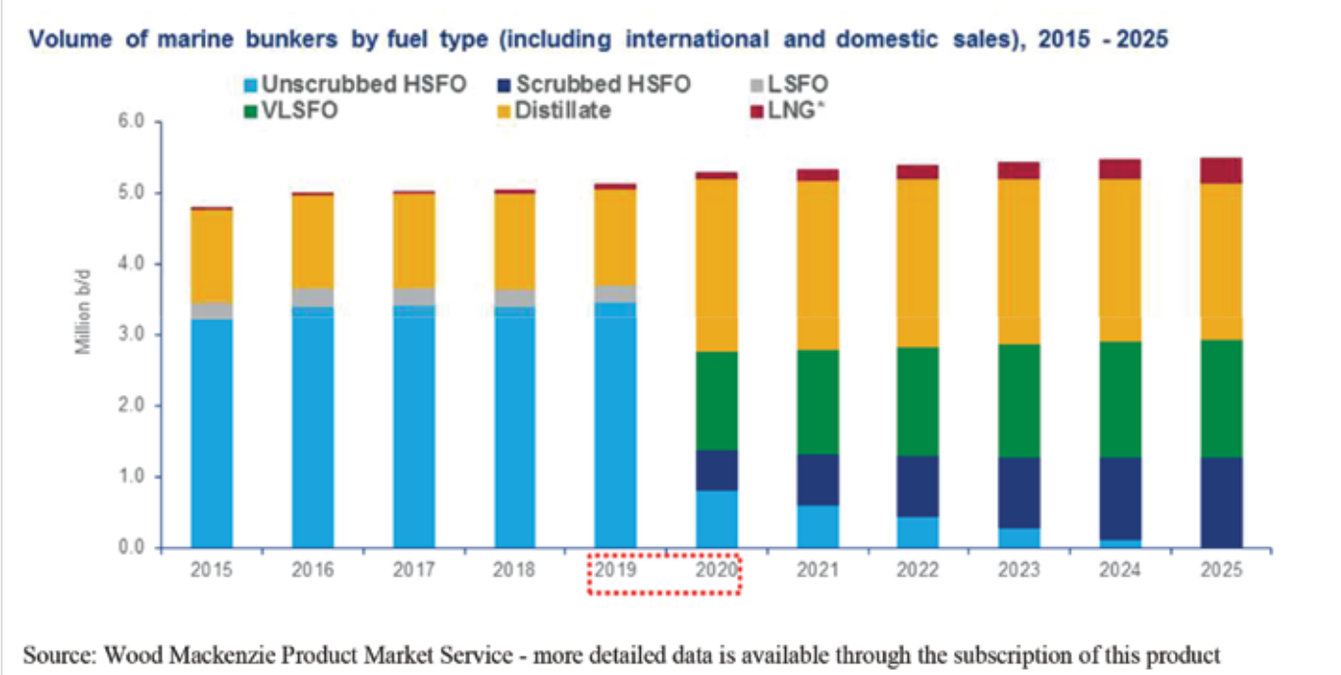
2. Global Impacts

2-1 Ship Owners and Operators

It will be the ship owners' responsibility to make sure their ship is compliant with the IMO's 2020 global sulphur limit. For ship owners, selecting the 'wrong' compliance strategy represents the biggest risk associated with the 2020 global sulphur limit, as it could place them at a severe disadvantage to their competitors. For ship owners, selecting the 'wrong' compliance strategy represents the biggest risk associated with the 2020 global sulphur limit, as it could place them at a severe disadvantage to their competitors. [23]

2-2 Insurance premiums

Marine insurance and its coverage will also be affected by the upcoming sulphur regulations. This can be introduced if, after 2020, a vessel is operating on fuel with low



[12]

Figure. 2

Marine cargo insurers are expected to revise their policies for any significant delay due to issues related to the global sulphur cap

sulphur content (new fuel product) it may cause engine damages, loss of propulsion or other problems which are not known yet. Due to any of mentioned matters vessel may become unseaworthy, thus that vessel may not have insurance because it's technically unseaworthy. Seaworthiness is the absolute inherent nature of marine insurance.

Furthermore, there is potential for voyage disruption and delays due to lack of compliant or compatible fuel at a bunker port, or due to mechanical failures caused by poor bunker fuel quality. Marine cargo insurers are expected to revise their policies for any significant delay due to issues related to the global sulphur cap. These new challenges may lead insurers to accept the risks by increasing their premiums, reflecting the uncertainties of the new reality. [22]

2-3 Charter parties

Charter party clauses relating to bunkers will also need to be reviewed to avoid disputes. A notable example are prices of different fuels: when a charterer, who takes delivery of a vessel, is also buying bunkers on board and re-sells them to the owner upon re-delivery. During the transition to the sulphur cap, there can be a big difference in fuel prices, and this risk must be accounted for in the charter party. Other risks include, among others, the unavailability of compliant or compatible fuel and the performance varying due to fuel quality. [18]

2-4 Refineries

Reports suggest that the best alternative to high sulfur fuel oil is diesel and this will increase diesel demand. Consumption of diesel as a marine fuel is likely to increase from 0.75mnbpd to 3.3mnpd in 2020. This will result in an additional demand of 2.6mnpd of diesel, which is almost 6X the average annual incremental demand since 2000. Since refineries will not be able to completely meet this demand, it will lead to a spike in diesel cracks and ultimately will improve overall

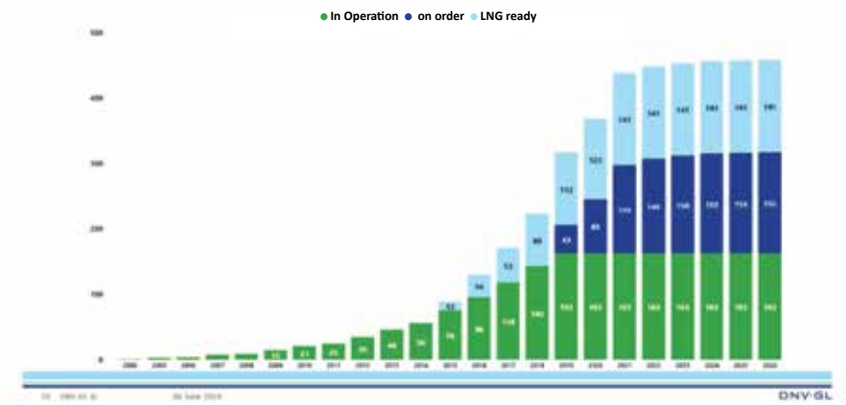


Figure. 3

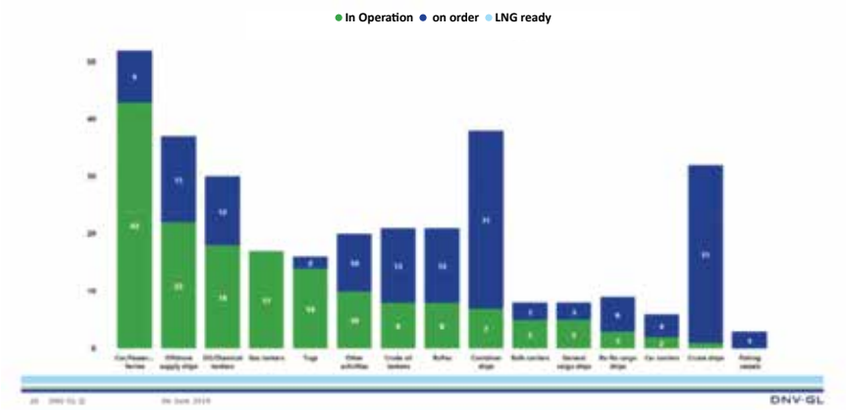


Figure. 4

refining margins.

IMO 2020 compliance requires a massive change that will demand rapid adjustments across the global fuel supply chain to comply with the 1 January 2020 deadline. (Figure 2)

Some calculations suggest that diesel cracks due to this could be improved to $25-$30/bbl (vs $15/bbl (Barrel) currently). Considering that diesel typically forms ~40 percent of the output for a complex refinery in Asia (45 percent for RIL (Reliance Industries) and OMC (Indian oil marketing companies) owned refineries such as Paradip, Bina and Bhatinda), gross refining margins (GRMs) at such plants could improve by US$ 4-6/bbl from 2020.[23]

3. Will the deadline of IMO 2020 be changed or delayed?

As the date is set in the MARPOL treaty, so it can only be changed by an amendment to the MARPOL Annex VI. This would require a proposal for an amendment to be put forward by a Member State that is a Party to Annex VI, that proposal then circulated and finally adopted by MEPC. An amendment to MARPOL is required to be circulated for a minimum of six months prior to adoption and then can only enter into force a minimum of 16 months after adoption. Parties to MARPOL Annex VI decided in October 2016 to implement the 2020 date.

Considering consistent by IMO and what has been said, legally, there can be no change in the 1 January 2020 implementation date, as it is too late now to amend the date and for any revised date to enter into force before 1 January 2020. However, IMO Member States will work in the relevant IMO technical bodies to address any issues that might arise with regards to ensuring consistent implementation. [17]

4. Non-compliance fuels

When a port state identifies clear grounds of suspected non-compliance fuel of a ship based on its initial inspections, then the port state may require samples of fuel oils to be analyzed. Where a sample is taken from a ship, a receipt should be provided to the ship and the ship should be advised of the outcome of such analysis.

If non-compliance fuel with IMO 2020 is established by a port state, the port state may prevent the ship from sailing until the ship takes suitable measures to achieve compliance, which may include de-bunkering all non-compliant fuel oil. However, ship's tanks are designed to receive fuel oil and not to pump it out, which renders de-bunkering very difficult and time-consuming.

In addition, the port state should report any non-compliance to the flag state. The port state should also advise the state in whose jurisdiction the bunker delivery note was issued in respect of non-compliant fuel oil.

When determining what sanction to impose on a non-compliant ship, a state party must take into account all relevant circumstances and the evidence presented, which may include not taking any steps against the non-compliant vessel. Flag and port state control authorities may take into account the ship's implementation plan when determining compliance with the 0.5 percent sulphur limit requirement. [19]

5. Non availability of compliant fuel

A Fuel Oil Non-Availability Report (FONAR) shall be submitted to

the flag state, with a copy to the port of destination, as soon as it is determined that compliant fuel oil will not be available.
The 2019 Guidelines in Appendix 1 of MEPC.320 (74) have a standard reporting format for a FONAR but state parties may develop more detailed guidance for the consistent use and acceptance of these reports, including specifying what evidence should accompany a FONAR.
In order to minimise disruption and to avoid delay, the Master or ship-owner should submit a FONAR as soon as it is determined, or becomes aware, that it will not be able to procure and use compliant fuel oil. The submission of a FONAR does not render a ship compliant with the Regulations but rather is a factor that shall be taken into account by a port or flag state when determining what steps to take against a ship for non-compliance. [20]

6. How could shipping comply with IMO 2020? Annually, more than 400 million tons of marine fuel is used to power shipping vessels. With heavy fuel oil no longer an option at 1st of January 2020, ship-owners must now look for alternative fuel or methods to comply with rule.

The three main methods of compliance and their advantages / disadvantages are summarised below.

6-1 Low/Ultra-low sulphur fuel
A type of fuel oil with sulphur level between 0.1 – 0.5%
Of the options available, the switch to low/Ultra-low sulfur fuel oils (LSFO/ULSFO) will likely be the most popular in the initial period, due to a lack of scrubber installations.

Most ships already have a separate fuel tank and already burn (0.1% compliant) ULSFO when entering the ECA's along the European and US coasts. The ports along these coasts facilitate ULSFO bunkering. But it remains a question of how much refiner capacity is available to facilitate the mass transition to ULSFO. [9]

Industry experts say Marine gas oils (MGOs) is the most hassle-free solution available and requires the fewest technical changes as vessels already have to use this fuel type within ECAs.
As of February 2019, the per ton price for heavy fuel oil stood at $420, compared to $647 for MGO. [11]

Advantages
- The most obvious solution, and the one which ships and crew are most familiar because low sulphur fuel oil has been the fuel used in ECAs for some time.
- Low sulphur fuel oil can either be HFO that has been de-sulphurised, or distillate fuels such as Marine Gas Oil (MGO).
- Increasing margins due to price difference between high suphur fuel oil(HSFO) and VLSFO

Uncertainty regarding the availability of LSFO / MGO in the volumes required for approaching 1 Jan 2020. The switch from HFO to LSFO / MGO by what is expected to be the vast majority (around 90-95%) of the world's fleet also requires a shift in production in refineries, with some estimating a production shift of up to 4 million barrels per day being required. Despite announcements by oil majors, future supply volumes remain uncertain.
- Concerns over quality, safety and compatibility as refiners seek to create new, untested blends of fuels which meet the new emissions standards. There is as yet no international standardization governing blended fuels, raising concerns about increased dangers to crew and vessel damage.
- Concern regarding the effect of LSFO / MGO on engines designed to run on thick, viscous HFO. LSFO / MGO has a much lower viscosity and can cause operational issues if appropriate advice is not taken from engine manufacturers.[5]

6-1-1 Distillate fuel issue
Distillate fuel will also have its own problems. There will be

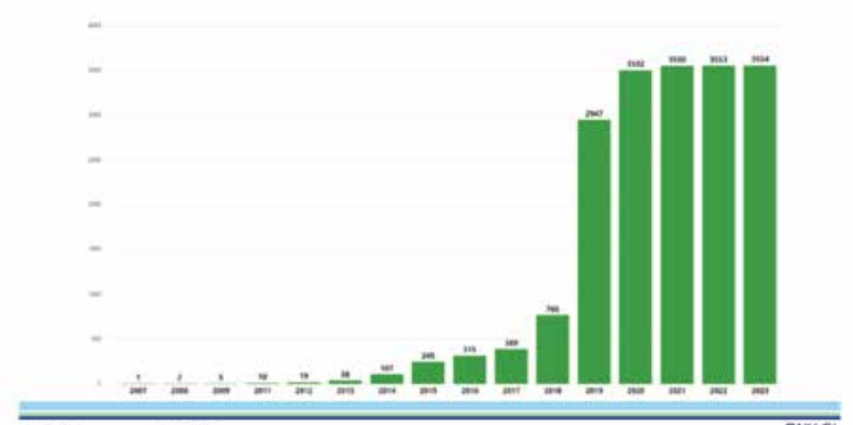


Figure. 5

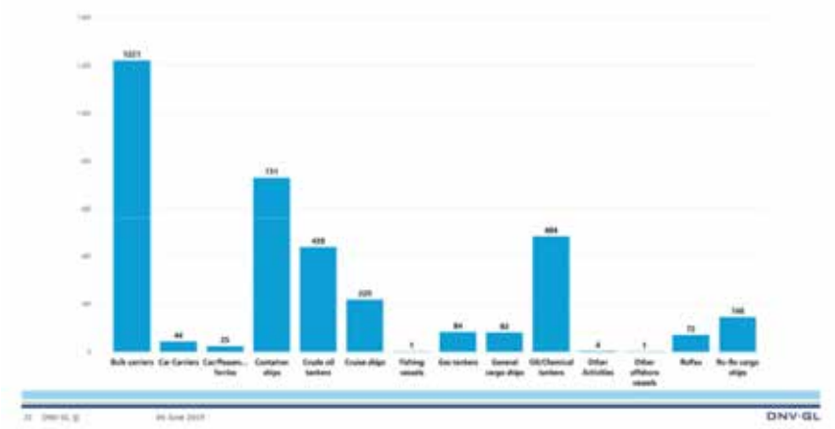


Figure. 6

lubricity problems, micro-bled contamination and high Total Acid Number (TAN) corrosion, as well as cold flow.

As for cold flow in distillate fuels, it is going to happen. The fuel will have to be tested for filter planning point, so be prepared for that. The bacteria problem can be there for quite some time.

Distillate fuels can be full of microbes and operators will have to shift first oil. When ordering the fuel oil you must have a plan of how to separate the new oil, how to avoid mixing and varying viscosity, lub. oil base number (BN LO) and Clarified Oil(CLO).[13]

6-2 Alternative fuels (LNG)

Pressurised natural gas (predominantly CH4) into liquid at the temperature of 260°F (-160°C) at the atmospheric pressure.

- Liquefied natural gas (LNG) is a particular type of ULSFO. Switching to LNG requires a more intensive and costly conversion process compared to the other solutions. It requires a modification of the engine that may not be possible for every ship that is not LNG-ready. [9]

Advantages

- Growing market for further revenue increase
- Suitable to remain compliant with the regulations

Disadvantages

- There is still room for further improvement in technology
- Lack of infrastructure and availability in marine industry (ports)

DNV GL indicated that 163 LNG ships are operating with 83 being on order. What is more, a total of 112 ships are LNG ready.

The number of LNG ready ships is expected to increase in 2020, reaching 123 vessels, with 163 operating and 83 being on order.

The number of LNG ships will in fact remain the same until 2026, but the LNG ready ships will increase to 141, with the orders gradually increasing every year, reaching 155 in 2026. (Figure 3)

Car and passenger ferries will be using mostly LNG, as 43 are already in operation, followed by offshore supply ships with 22 and oil/chemical tankers with 18. [14] (Figure 4)

6-3 Exhaust gas cleaning systems (Scrubber)

Reduction in the emissions of sulphur to the atmosphere by more than 80%

The second option for compliance is fitting ships with so-called exhaust scrubbers. An exhaust scrubber is a device that cleans exhaust gasses with water. Ships with scrubber installations are allowed to run on HFSO under the new regulations. This means that they can benefit from the lower price of HSFO. [9]

Advantages

- Exhaust gas cleaning systems or “scrubbers”, “clean” the emissions before they are released into the atmosphere. If scrubbers are installed, the vessel can continue to use HFO.
- Significant fuel cost savings over low sulfur MGO.MGO is typically 50% to 70% higher in cost than HFO.

Economical solution with short time payback.

- Less expensive and faster to put in place than a major refining upgrade

Disadvantages

- New equipment to the market
- The time and cost of installation and maintenance. Retrofitting a scrubber system is no small task – it takes around 6 weeks and at least a few million dollars. Recent estimates are that around 10% of the world’s container ship fleet will be fitted with scrubbers coming 1 Jan 2020 although that is likely to increase as new builds are delivered.
- Recently, some jurisdictions have banned the discharge of wash water from “open loop scrubbers”

- When the cost difference between HFO and MGO (Low Sulphur Distillate product) is low, scrubbers are less profitable.
- As of now, scrubber supply side is limited and thus market share above 15% by 2020 is not expected.
- The need to retain some stores of LSFO / MGO onboard for operations in ECAs or in the event the scrubber breaks down. Uncertainty regarding ongoing supply and price of HFO, as refineries switch production to meet the increased demand for LSFO / MGO.[5]

6-3-1 Scrubber installation

If shippers order a scrubber now the current lead time (waiting period plus instillation) is around 6-9 months. Installation is quite quick (2-4 months, requiring incremental investment of about $3-5m). However, instillation requires a dry dock and a limited number are suitable or available. [16]

As much as 16% of the global containership fleet by vessel count and 35.7% in terms of capacity have been equipped with scrubbers as at end-May, seven months ahead of the implementation of the IMO 2020 regulation, according to Alphaliner data.

Scrubbers have been installed on and ordered for 844 containerships with a combined capacity of 8.09m TEU, breaking down to 590 ships to be retrofitted, 181 new buildings, and 73 delivered and existing ships. The figures compared to a total global fleet of 5,272 ships of 22.66m TEU, including an order book of 420 ships of 2.55m TEU, as at end-May 2019. [7]

Currently a total of 2947 ships are equipped with scrubbers. This number will increase significantly in 2020, reaching 3502. After 2020, more increase in the use of scrubbers will be recorded, but with a more moderate pace. [14]
(Figure 5)

Regarding the specific ship types, bulk carries have the most scrubbers with 1221. Second, by far, are container ships with 731, and then oil/chemical tankers with 484. [14] (Figure 6)

7. Operating cost and utilization

Increase in fuel costs leads to significant rise in operating costs, which will lead to higher freight costs worldwide. In summer 2018, top carriers such as Maersk (Danish international container shipping company), CMA CGM S.A. (French container transportation and shipping company) and MSC (Mediterranean Shipping Company S.A.) announced to add bunker charges to compensate for the unexpected increase of bunker costs. For this purpose a bunker adjustment factor (BAF) tariff was created to recover fuel related costs. It can be charged separately from the basic ocean freight as the fuel cost is a very significant and volatile part of shipping costs.

BAF=Fuel price ×Trade factor

The fuel price is calculated as the average fuel price in key bunkering ports around the world, and the trade factor reflects the average fuel consumption on a given trade.

As the fuel consumption increases with the speed of a ship certain degree of speed reduction would be observed to reduce operating expenses. The average speed of ocean going vessels has come down by 15-25% over the last decade (see graph below). Operating speeds may be reduced even further

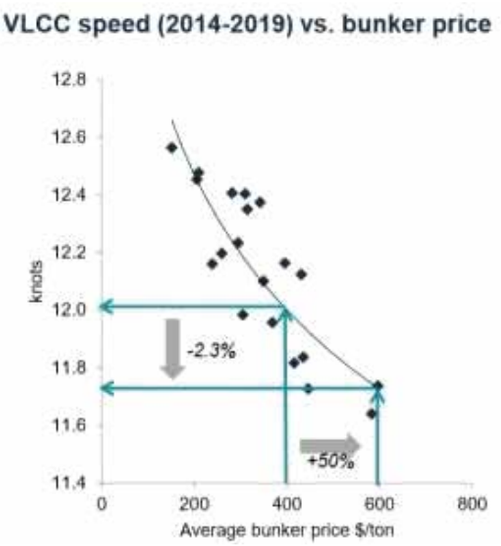


Figure. 8

Fuel-efficient vessels will be more competitive, while vessels with scrubbers installed may have a significant competitive advantage.

as bunker prices become more expensive. [2]

Fuel-efficient vessels will be more competitive, while vessels with scrubbers installed may have a significant competitive advantage. It is expected that, initially, vessels with scrubbers will be able to secure premium charter rates.

Summery

On January 1, 2020 the IMO mandate for 0.5% global sulphur cap for marine fuels will come into effect. This is an effort to reduce air pollution and improve health and environmental benefits globally.

The new limitation on sulphur content will definitely affects the supply and the demand side of the shipping market. Therefore, it is equally important for supplier and shipping companies to understand the business factors that will impact their business operations and develop a strategic response.

Involved parties must introduce their own plan to handle the affects and perform methods to reduce cost and minimize revenue loss. The plan should consider risks involved, market behavior, regulatory compliance and operation aspects.

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SSLIL established in 1967 and presently it is one of the companies in IRISL Group. The core activity of the company is terminal operation & logistics, as well as providing cargo support and container inland services. The company manages and operates a terminal network country-wide with direct interest in 4 operating ports and terminal facilities.

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3. Providing logistic services according to customers' requirements.
4. Stripping and stuffing of containers.
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6. Providing all necessary facilities at logistic sites for change of transportation mode.
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NEW HEADWINDS IN MEETING EMISSIONS RULES

By: Sam.Fathololumi, Senior Technical Expert Engineer

Maritime and shipping activities constitute a significant share of air pollutants and greenhouse gases emissions. Gases produced from shipping activities in the port, maritime and marine industries include: greenhouse gases (CO2), carbon monoxide (CO), Black carbon (BC), and Non- CO2 greenhouse gases (sulphur oxides (SOx), nitrogen oxides (NOx) and small particulate compounds (PM).

There is a general distinction between greenhouse gas (GHG) and Non- CO2 greenhouse gases (NON-GHG) emissions. Greenhouse gases contribute to global climate change and have an impact on the ozone layer, global warming, and acid rain, while Non- CO_2 greenhouse gases generally have adverse effects on human health and the environment.

Maritime transport has a major impact on Non- CO2 greenhouse gas emissions. Based on this controlling sulphur emissions is of great important. For example, if fuel contains 3.5 percent sulphur, it will produce 77 kg of sulphur dioxide and if the same fuel contains 0.5% sulphur, it will produce 11 kg of SO3. As a result, fuels with lower sulphur content would make a considerable contribution to preserve human health and to protect the environment. They will not result in respiratory and heart diseases as well. Concerns by international communities over rising air pollution have led to the international community's

determination to formulate and enforce stringent environmental regulations. MARPOL Annex VI, first adopted in 1997, limits the main air pollutants contained in ships exhaust gas, including sulphur oxides (SOx) and nitrous oxides (NOx), and prohibits deliberate emissions of ozone depleting substances (ODS). MARPOL Annex VI also regulates shipboard incineration, and the emissions of volatile organic compounds (VOC) from tankers.However, the unwillingness of the countries to implement the requirements of the new annex, had forced regulators to enforce this annex two years later (in year 2005).

Under the MARPOL Annex VI regulation 14, limiting the amount of sulphur in ship fuel to 5/3% (m / m) was permitted. Emission Control Areas (ECAs), or Sulphur Emission Control Areas (SECAs), are sea areas in which stricter controls were established to minimize airborne emissions from ships, including; Baltic Sea, North Sea, North American, and United States Caribbean Sea. In effect since 2015, within the control areas, the sulphur oxide emissions limit is 0.10% m/m. This will not be changed with IMO 2020 regulations.

Between years 2008 and 2010, the IMO began revising Annex VI and introduced stricter regulations as part of a sulphur reduction plan for all regions of the world. According to the review, all regions of the world (Except for ECA zones where the sulfur limit reached 0.1) were obliged to reduce fuel sulfur content to 3.5% in 2012 and half a percent sulphur in 2020.

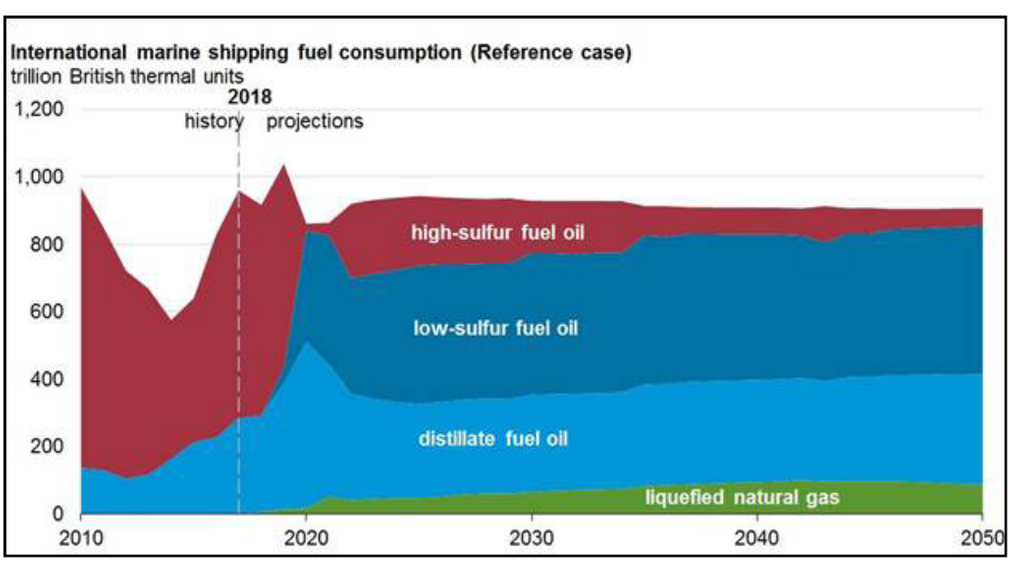
Although developing countries and mainly the Middle East - producers of crude oil and fuel - due to constraints ahead, they began negotiations to delay the implementation of IMO 2020, however, the low sulphur fuel requirements for 2020 will be certainly enforced. Greece has been leading a campaign to push back the implementation of a clean-fuels mandate for the shipping industry. The new regulation scheduled to take effect Jan. 1, when some 60,000 oceangoing vessels are required to cut their sulphur emissions by more than 80%. According to the wall street journal report, the actions will substantially raise operating costs and prompt ship operators to reconsider what will power their vessels in the future. Cleaner fuels aren't being widely traded, but prices are expected to be up to 40% higher than the heavy oil now in use.

Requirements for Sulphur Cap Low Fuel Reduction and Solutions ahead

Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) limits emissions for ocean-going ships by 2020 (IMO 2020). From January 1, 2020, the limit for sulphur in fuel used on board ships operating outside designated emission control areas will be reduced to 0.5% m/m (mass by mass), a reduction of more than 85% from its present level of 3.5% m/m. Ships can meet the new global sulphur limit by installing pollutant-control equipment (scrubbers); by using a low-sulphur, petroleum-based marine fuel; or by switching to an alternative non-petroleum fuel such as liquefied natural gas (LNG).

It is worth mentioning that this regulation will have a significant impact on the prices of marine fuels, crude oil products and global maritime transport. Under regulation 18.1 of MARPOL Annex VI, each State Party shall take the necessary measures to ensure that adequate fuel is available in their ports and terminals, and if the ship fails to receive fuel in accordance with Rule 2020, it can inform other countries and the IMO.

The IMO 2020 sulphur cap as the new regulation will have a huge effect in the supply chain. Some experts believe that we can expect large-scale disruptions in global



supply chains. The implementation of this law would bear the additional costs on the shipping industry. Maersk and MSC shipping lines announced that they face annual extra costs of more than $2 billion separately.

Ways to implement the new low-sulphur fuel law:

As mentioned earlier, using half a percent sulphur fuel will have a significant impact on the final price of the service provided by shipping. Ship owners will strive to avoid price changes in their services by using other means provided by law. The ship owners have a few options to ensure compliance and meet lower sulphur emission requirements

Some ways to reduce the sulfur produced by ships is as follows:

1-Installation of a scrubber system (sulfur oxide purification system):

Scrubbers are systems for purifying exhaust gases from the engine of a ship, which can remove sulphur coming out from exhaust and continue to use HSFO (High Sulfur fuel oil)

It is possible to use these devices in accordance with IMO rules but it has its own technical and environmental problems.

Vessels with scrubbers installed will be permitted to carry fuel with a sulphur content of < 3.5% m/m, but due to the high power consumption and space of system, scrubber can be installed on new and larger vessels with high installation costs. Another challenge is that maintenance cost is not very affordable.

2. Use of liquefied petroleum gas (LNG):

Using this method will increase the cost of building LNG-compatible ships.

LNG fuel containing Methane gas, resulting in a loss of fuel, and failure to fully combust methane gas can cause explosions and damage to vessels. LNG fuel needs large storage and disposal facilities.

3. Use appropriate sulphur fuel as required by law (low sulfur fuel)

The content of sulfur in the fuel is low, but due to the global shortage of production, it has a higher price than other high sulphur fuels.

Fuel or scrubber

If at the beginning of 2020, the price of fuel in accordance with IMO standards is maximized, it only takes a few months to return scrubber costs. But the concern of ship-owners is the initial cost of three to five million that they have to pay without any guarantee of their use. If the difference between the price of marine diesel fuel and HSFO remains very low, the use of these systems will not be justified.

Keep in mind that if the cost of a five-year Super Max ship is five years to build, $ 14 million, it costs about three to five million dollars for a scrubber system. If a ship

This regulation will have a significant impact on the prices of marine fuels, crude oil products and global maritime transport

Option	Advantages	Disadvantages.
Low Sulphur Fuel	Most environmentally friendly solution	High cost, low availability
LNG	Negligible sulphur oxide emissions	High infrastructure costs; too expensive to convert older ships
Scrubbers	Cleans emissions before they are released into the atmosphere	it requires substantial investment; ships must be sent to dry dock for scrubber retrofitting; lines need to comply with discharge of scrubber wash water regulations in various countries

consumes 50 tons of fuel daily and be steaming for 200 days a year, and while the price difference of ULSF to HSFO is $ 200 per ton, the cost of the ship is $ 2 million a year. On the other hand, the cost of installing a scrubber system is between two and four million dollars.

For this reason, ship-owners should carefully analyze their cost-benefit for using ULSF fuels or installing scrubbers to enter pollutant control areas.

LNG is also used as fuel, but not cheap fuel, switching ships to use LNG fuel is not economically viable today and very few of the world's commercial vessels currently operate on LNG fuel. However, usage of LNG at ships is on the rise and the number of these vessels may increase exponentially in the coming years. It should be borne in mind that the global LNG marine fuel supply infrastructure remains limited. On the other hand, this fuel requires the cooling system for fuel tankers. And this will reduces cargo space.According to shipping and freight resource, IMO2020 is getting serious commercially and all ships are required to use fuel with a sulphur content of 0.5%. It is estimated that 3.9 million barrels a day is used on ships traversing the ocean. However, various lines have been using various methods as listed above and only time will tell us which of the options is warmly welcomed by ship owners and operators. "The impact on shipping in terms of cost to protect the environment will be the biggest in history," Mr. Lim said. "It's not going to be easy, but it has to be done."

LNG is also used as fuel, but not cheap fuel, switching ships to use LNG fuel is not economically viable today and very few of the world's commercial vessels currently operate on LNG fuel

UNCLEAR FUTURE FOR MARINE FUELS

By: Mohsen Mohammadi Asl, Ship's Chief Engineer

The majority of vessels will be using more expensive low-sulphur fuel to IMO 2020. The higher cost will make biofuels more competitive, According to Lloyd's list report.

In recent years, the consumption of fossil fuels such as oil, gas and coal as energy sources has dramatically increased. This trend is considered as a big threat to the earth and all its organisms. Consequences of this heavy consumption are air pollution, global warming , acidic rain, reduce the thickness of polar ice and drought, etc.one of the harmful products caused by the burning of fossil fuels is carbon dioxide (co2) .It is most common greenhouse gas emitted through human activities in terms of the quantity released and the total impact on global warming.

Considering the harmful effect of using fossil fuel, international organizations have adopted domestic and international laws to combat air pollution. This critical issue persuaded International Maritime Organization (IMO) to change and revise air pollution regulation. Main changes to MARPOL Annex VI are a progressive reduction globally in emissions of SO_x, NO_x and particulate matter and the introduction of emission control areas (ECAs) to reduce emissions of those air pollutants further in designated sea areas.

Prevention with SOX, NOX, from marine vessel

New International Maritime Organization (IMO) regulations,

due to take effect in January 2020, aim to drastically lower the sulfur cap for air emissions from ships. Under the revised MARPOL Annex VI, the global sulphur limit will be reduced from current 3.50% to 0.50%, effective from 1 January 2020. Shippers have three main options to meet the new low-sulfur requirements. They can run on another fuel such as liquefied natural gas (LNG); they can continue to use Heavy Fuel Oil and process air emissions through an exhaust gas cleaning system (EGCS), more commonly called “scrubber which must be fitted on board the ship; or they can switch from HSFO to a lower-sulfur fuel, such as marine gasoil (MGO) or a new type of residual fuel known as low-sulfur fuel oil (LSFO).The control of diesel engine NOx emissions is achieved through the survey and certification requirements leading to the issue of an Engine International Air Pollution Prevention (EIAPP) Certificate.

Carbon dioxide (CO2) enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and it is one of greenhouse gas which causes the climate change and increase temperature of earth . Shipping could be responsible for 17% of global CO2 emissions in 2050 if left unregulated, according to a new scientific stud. Any agreement at the Paris Climate Summit must therefore send a clear signal to the International Maritime Organization (IMO) that CO2 reduction targets and measures for shipping are needed to help keep warming below dangerous levels.

The third International Maritime Organization greenhouse gas study 2014 estimated that international shipping emitted 796 million tonnes of CO_2 in 2012, accounting for about %2.2 of the total global anthropogenic CO_2 emissions for that year, and that emissions from international shipping could grow between %50 and %250 by 2050 mainly due to the growth of the world maritime trade. In this regard, International Maritime Organization has been actively engaged in a global approach to further enhance ship›s energy efficiency and develop measures to reduce GHG emissions from ships, as well as provide technical cooperation and capacity building activities.

To peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO_2 emissions reduction consistent with the Paris Agreement temperature goals.

In April 2018, the IMO adopted the initial strategy on the reduction of GHG emissions from shipping (the “Initial Strategy”, for short), a historic agreement that aims to bring the sector in line with the ambition of the Paris Agreement

Any agreement at the Paris Climate Summit must therefore send a clear signal to the International Maritime Organization (IMO) that CO2 reduction targets and measures for shipping are needed to help keep warming below dangerous levels

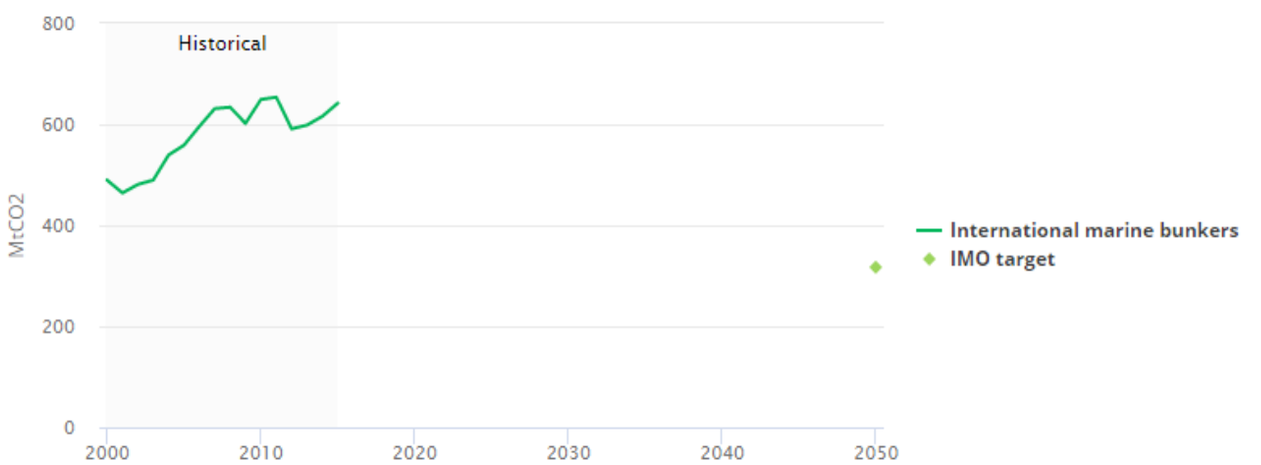


Figure 1.the IMO Aim to cut absolute GHG reductions by at least 50% by 2050,

Maritime Organization has been actively engaged in a global approach to further enhance ship›s energy efficiency and develop measures to reduce GHG emissions from ships, as well as provide technical cooperation and capacity building activities

climate goals. The strategy includes a target to reduce the carbon intensity of international shipping by at least 40% by 2030 compared with 2008, and to pursue efforts to reduce emissions intensity by 70% by 2050. Figure 1

It further aims to cut absolute GHG reductions by at least 50% by 2050, and thereafter to pursue efforts to phase them out altogether.

Currently, the only IMO regulation in place to address GHG emissions from ships is the Energy Efficiency Design Index (EEDI), an efficiency standard for new ships. This mandate requires an annual energy efficiency improvement of the fleet of only 1% on average between 2015 and 2025.

The new climate strategy will have far-reaching consequences for the sector, requiring the very rapid adoption of efficient technologies and fuel switching, at a much faster pace than has been achieved to date.

Nevertheless, while the Initial Strategy includes a list of candidate short-, mid- and long-term measures, the EEDI is the only emissions regulation currently in place. Swift implementation and rapid scale up of new measures, including a strengthened EEDI, an operational efficiency standard, a low-carbon fuel mandate or standard and a carbon pricing mechanism are essential to decarbonize shipping. In total can be concluded for a better life of ourselves and our world now and in the future all countries need to step up efforts to control and prevent outdoor and indoor air pollution. Reducing the projected harmful effects of rapid climate disruption during this century requires emergency action to increase energy efficiency, sharply reduce greenhouse gas emissions.

Decisive action to this trend will allow the shipping sector to contribute to the global low carbon transition – and reap the benefits of further energy efficiency improvements. At the same time, maritime transport is currently the only transport mode and economic sector without a greenhouse gas emissions reduction objective.

Reduction CO2 Emission with Alternative Fuel

The combined effects of decreasing availability of light crude oil, increased demand for global merchant shipping, and stricter

DNV.GL Summary of an assessment of selected alternative fuels

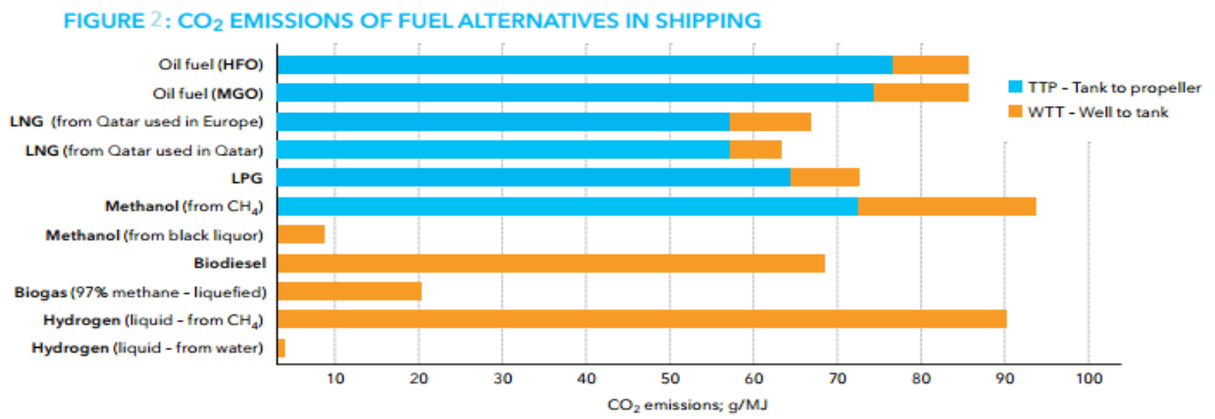


figure2. Co2 emission of fuel alternative

marine fuel regulations have caused a search for competitively produced marine fuel alternatives with low Sulphur content and low carbon footprint. Alternative fossil-based fuels such as LNG and LPG have low Sulphur and nitrogen oxide emissions, but have a limited contribution to reducing greenhouse gas emissions. Biofuels, however, have a much larger potential to combat climate change and reduce emissions over their full life cycle. Denmark's Maersk, the largest shipping company in the world, is looking at biofuels already in its efforts to reduce its carbon footprint. Maersk has set a more ambitious target for itself than that of the IMO, aiming to make "commercially viable" carbon-neutral vessels into service by 2030 and targeting net-zero carbon dioxide emissions by 2050.

Alternative Marine Fuels

- Low Sulfur Marine Fossil Fuels for Sox
- Ultra-Low or Low Sulfur Diesel (ULSD and LSD)
- Biofuels
- Biodiesel (FAME)
- Algae Fuels (not yet available)
- Hydrogenation-Derived Renewable Diesel (HDRD)
- Methanol
- Dimethyl-Ether (DME)
- Bio Crude (Pyrolysis oil)
- LPG (liquid petroleum gas)
- LNG (liquid natural gas)
- ammonia

As LNG gains traction as a clean fuel solution, greater numbers of LNG-powered vessels are being built; the global order book for 2019 lists 17% of new build orders (in gross tonnage) as LNG-powered. The other clean fuels are hydrogen and ammonia. Intrinsically carbon free, these fuels produce zero CO_2 emissions when sourced renewably, and both are clean fuel solutions for internal combustion engines and fuel cells. It is to be noted that both fuels have a much lower energy density than traditional fuel oils; this needs to be accounted for in ship design and will impact costs. The long-term, long-distance onboard storage of liquid or compressed hydrogen remains a technical challenge that will be expensive to solve in the short term. So, despite the possible applications of pressurized or liquid hydrogen for transport, ammonia – which acts as a hydrogen carrier – currently shows greater promise as a zero-carbon

The combined effects of decreasing availability of light crude oil, increased demand for global merchant shipping, and stricter marine fuel regulations have caused a search for competitively produced marine

Biofuels also tend to require subsidies and other market interventions to compete economically with fossil fuels, which creates deadweight losses in the economy

fuel for shipping. For ammonia, the processes for storage and transport are well established. Moreover, it is one of the most widely used chemicals in the world, with global production levels of around 190 million tons per year. It is therefore widely available, although marine bunkering infrastructure would need to be developed. In addition, safety issues associated with ammonia's toxicity and caustic properties, which create the need for careful storage and handling, are to be addressed – ultimately through regulation. The biofuel trial on board Mette Maersk has proven that decarbonized solutions for shipping can already be utilized today, both technically and operationally. While it is not yet an absolutely final solution it is certainly part of the solution and it can serve as a transition solution to reduce CO2 emissions today. With the launch of this product, Maersk seeks to help our customers with their goal of moving to sustainable supply chains, explains Søren Toft, Maersk COO. The biofuel to be utilized is carbon neutral and provides, H&M Group the ability to reduce their transport and logistics emissions towards their aspiration of carbon neutrality, when accounting for only the emissions from the vessel. The Roundtable on Sustainable Biomaterials (RSB) will provide a procedure to ensure carbon savings are accredited to our customers appropriately. When taking a full lifecycle view including also all emissions from upstream production and transportation, the fuel entails savings of 85% compared to bunker fuel. The goal of such pilot projects is to unlock the potential of sustainable fuels so they become a commercial reality, the company added.

Ammonia can be safely and effectively applied as a marine fuel to reduce harmful emissions in the maritime industry according to new research published today (12 June) by C-Job Naval Architects, the largest independent ship design and engineering company in the Netherlands. The research uses a new concept design, an ammonia carrier fueled by its own cargo, to study the concept of using ammonia as a marine fuel and achieve a significant reduction in greenhouse gas emissions in shipping. Niels de Vries, Lead Naval Architect at C-Job Naval Architects and research lead, says: "Reviewing all ammonia power generation options, the Solid Oxide Fuel Cell (SOFC) is clearly the most efficient. However, it does have practical challenges as the power density and load response capability are not on an acceptable level yet. Therefore, in the short term applying the internal combustion engine is the way to go."

Assess the net effect on greenhouse gas emissions of replacing fossil fuels

To assess the net effect on greenhouse gas emissions of replacing fossil fuels by biofuels, we need to analysis emissions throughout the whole process of producing, transporting and using the fuel. Life-Cycle Analysis is the main tool used to do this. It compares a specific biofuel system with a reference system – in most cases petrol.

Greenhouse gas balances differ widely depending on the type of crop, on the location, and on how feedstock production and fuel processing are carried out. Biofuels from some sources can even generate more greenhouse gas emissions than fossil fuels.

A significant factor contributing to greenhouse gas emissions is the amount of fossil energy used for

feedstock production and transport, including for fertilizer and pesticide manufacture, for cultivation and harvesting of the crops, and or in the biofuel production plant itself.

Replacing fossil fuels with biofuels—fuels produced from renewable organic material—has the potential to reduce some undesirable aspects of fossil fuel production and use, including conventional and greenhouse gas (GHG) pollutant emissions, exhaustible resource depletion, and dependence on unstable foreign suppliers. Demand for biofuels could also increase farm income.

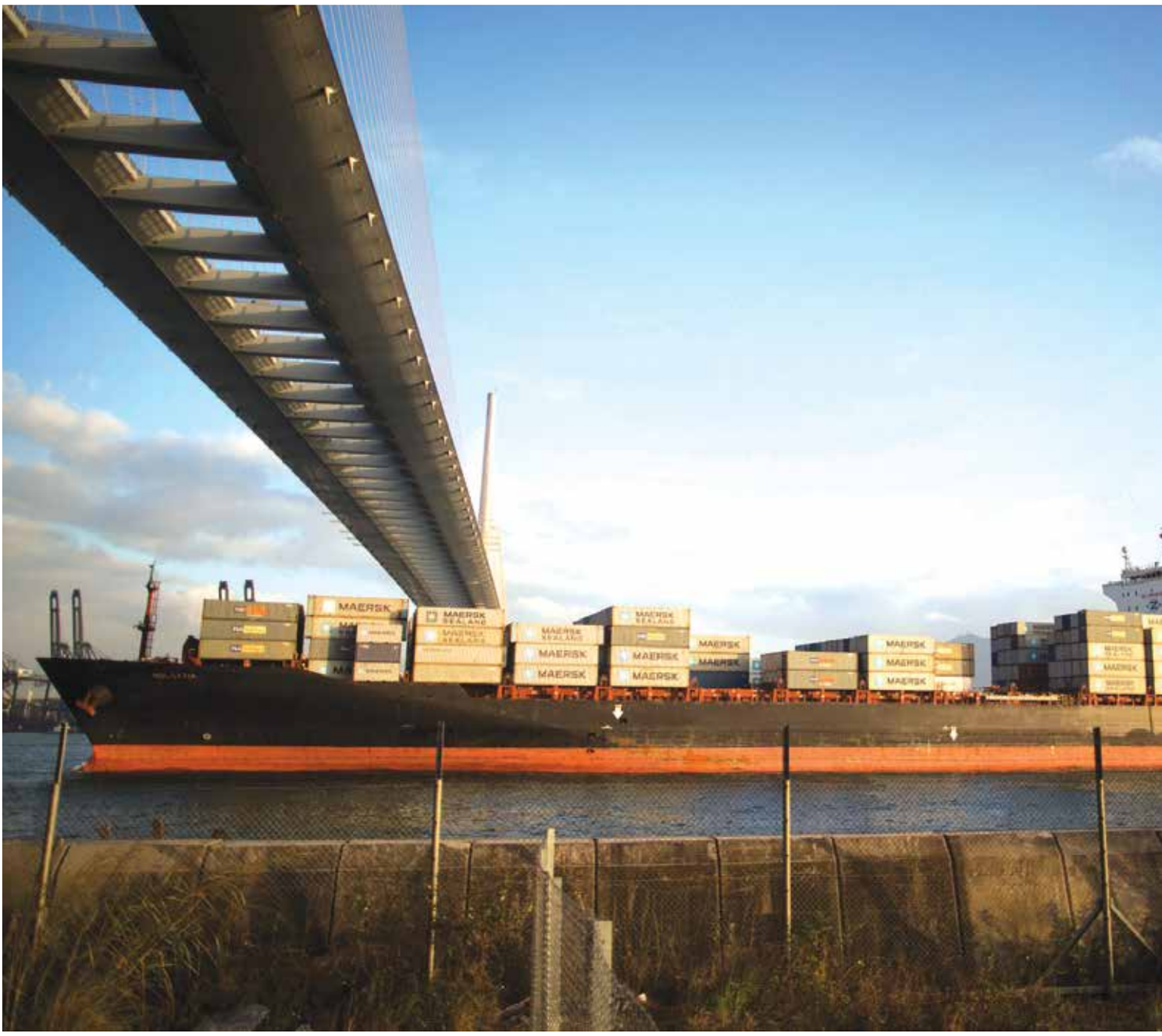
On the other hand, because many biofuel feed stocks require land, water, and other resources, researchers suggest that biofuel production may give rise to several undesirable effects. Potential drawbacks include changes to land use patterns that may increase GHG emissions, pressure on water resources, air and water pollution, and increased food costs. Depending on the feedstock and production process and time horizon of the analysis, biofuels can emit even more GHGs than some fossil fuels on an energy-equivalent basis. Biofuels also tend to require subsidies and other market interventions to compete economically with fossil fuels, which creates deadweight losses in the economy.

Several available alternatives to HFO, MGO and MDO can be found today. Gas (CNG or LNG) is regarded the most commercially available fuel. The Sox-emissions of these fuels are very small, which is also the case for particulate matter. The NOx-reductions may also be significant. Fossil fuel, either in the shape of LNG or CNG, does to some extent solve some challenges with regards to local emissions and NOx, however these fuels can only prompt slight reductions in CO2 emissions in a well-to-wheel perspective. Production of LNG is energy intensive and leads to significant emissions of CO2. Also there are some emissions of non-combusted Methane that will further reduce the climate benefits of using LNG in ships.

Today's available CO2-neutral and emission-free vehicle solutions are first and foremost biofuels, electric- and hydrogen operated cars. Electricity and hydrogen may to some degree be possible alternatives for some ships, such as ferries. However, the installation of the said technologies is likely to demand extensive refitting, alterations or even replacement of present engines. One should also keep in mind that this is not commercially available technology.

Biofuels and its compatible technology, on the other hand, can be ordered and delivered fairly hassle free. It should be noted that sails are also an emission free ship-alternative. Such a seemingly retrograde step for shipping may seem irrelevant to today's modern shipping fleets. However there are currently a number of projects whose aim is to develop kite like sails for major cargo ships. Whether this will be a relevant substitute or supplement to engine power remains to be seen. Also hybrid technologies involving sails, solar, waves and hy-

Figure3: SWOT analyses of marine fuels from biomass (Strong, Weakness, Opportunity, and Threat)



drogen solutions may become more relevant in the future. However interesting this may be, for the time being we should focus attention on existing alternatives. Consequently the introduction and use of biofuels stands out as the most appropriate action to bring about in order to obtain rapid reduction in levels of CO2 from shipping.

Maritime transport is and remains one of the most vital forms of freight transport. Maritime merchant shipping is among the fastest growing sectors within the transportation industry, and plays an important role in the world's economy and environment. Marine shipping is a relatively low-energy mode of long-distance transportation, and continues to improve its energy efficiency and cost-competitiveness to survive in a competitive market with alternatives such as road and aviation transport. There are also operational advantages in utilizing maritime routes instead of road transport, as goods can arrive faster via ports and at the same time achieve a reduction in GHG emissions.

With the current fuel volumes demanded by the merchant shipping industry and new regulatory fuel requirements, there is a strong market potential for biofuels and LNG, particularly biofuel blends. While the first generation bioethanol and biodiesel industries have already

been commercially established, as of 2016, there has been slow development and shifting support for the production of second generation biofuels.

The use of biofuels in shipping presents itself as an opportunity to lower GHG emissions and improve air quality, given that biofuel feed stocks contain very little or no Sulphur. Developing the infrastructure and supply chain for biofuels is also a chance to build a sustainable bio economy. As commercial marine biofuel production takes off, it is possible that the feed stocks for marine biofuel production will compete with other liquid transportation fuels, especially for aviation. However, the refining processes for marine fuels will be much less intensive, and could even be integrated together with aviation fuels.

The environmental benefits, along with current regulatory policies and governmental support schemes make a strong business case for biofuel production. The transition to biofuels or biofuel blends will likely be led by 'forward thinking' shippers, large freight shipping companies, and shipping companies with high-end customer profiles such as ferry and cruise companies. Biofuels does with a few exceptions offer a net reduction of carbon cost, especially those produced from second and third generation feed stocks, and thus lower the carbon emissions produced by the shipping sector. An overall reduction of GHG emissions in the merchant shipping sector would most likely be achieved through a combination of improvements in ship design, port infrastructure, and fuel technology. Presently, the EEDI (energy efficiently design index) can serve as a business case for promoting advanced biofuels: EEDI encourages the ship owners/operators to use more energy efficient and low-carbon technologies to power their ships, while at the time of writing it is unclear how will cover the maritime sector, it is an example of how fuel suppliers and/or bunker parties may be given an obligation to deliver biofuels to the market. In the long run, alternative fuels could offer further DE carbonization opportunities, as long as these fuels come from renewable energy sources.

Biofuels does with a few exceptions offer a net reduction of carbon cost, especially those produced from second and third generation feed stocks, and thus lower the carbon emissions produced by the shipping sector

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MARITIME TRANSPORT SYSTEMS AND THE 4TH INDUSTRIAL REVOLUTION IN THE THIRD MILLENIUM

By: Mehdi Rastegary, Senior Advisor in Padid Avaran Omid Pars Co.

The 4th industrial revolution is an emerging transformative paradigm that will change the entirety of human life on planet Earth in the coming years. This basic paradigm shift is induced by the rapid pace of evolutions in a number of science and technology fields including ICT, genetics and biotechnology, material science and nanotechnology, energy supply and consumption and many others. We have entered into a new era: we can render nearly everything into smart items, and the progress towards developing higher levels of artificial intelligence in these smart items enables them to interact and learn. We are developing big data as a new resource for economic value production. We are achieving renewable, clean and nearly free energy supplies that will replace the fossil fuels throughout the world in a short time. Also our achievements in genetics and biotechnology are transforming the concepts of health, life expectancy, food and energy supply and many more. Many scientists and technologists believe that the developments of human societies in the coming two decades will be much further than all developments which have taken place through the past 300 years.

This is happening in a context where humankind is also challenged by several other issues in the beginning of the third millennium. We are on the verge of experiencing the extreme consequences of climate

change in the coming years. The human population has explosively grown within the past century and this has exacerbated the imbalanced development of human societies on the planet, and led to escalate conflicts over vital resources. Pollution and excessive use of natural resources have damaged to the environment. Sustaining the life of the human population by the current means will be impossible soon. Some believe that the 4th industrial revolution as well as the multitudes of solutions developed and offered within this new paradigm, can be used to address these challenges effectively.

Maritime transport will be undoubtedly impacted by both the 4th industrial revolution and the crushing forces of the third millennium challenges. As the main vessel of international trade, maritime transport is an underpinning component in the global economy system. As once said by E. Mitropoulos, if shipping stops, half of the world will starve in hunger and the other half will freeze in gloom. In this sense, the world demands effective, cost-efficient, and clean services from the shipping industry in order to tackle the third millennium challenges. But in this context, the shipping industry is also involved in its own set of challenges. For years, the industry has been involved in the trough-side of an estimated 25-year cycle in its revenue making. Due to the size of the global fleet, the industry's supply is much further than the market's demand. Moreover, the industry is encountering a new series of environmental requirements that incur very heavy costs and generate operational and technical constraints in it. Among these requirements, one can point to ballast water management, the global sulphur cap, the coming greenhouse gas control requirements, and so on. In this sense, we can say that in the advent of the 4th industrial revolution and in the upfront of encountering the global challenges of the 3rd millennium, the shipping industry is itself in an uneasy state.

Maritime transport will be undoubtedly impacted by both the 4th industrial revolution and the crushing forces of the third millennium challenges

The 4th industrial revolution can have critical effects on the global maritime transport system

The patterns and amount of demand for shipping may be impacted dramatically by the surging rise of new trends like 3D printing. Having the blueprint for manufacturing nearly everything with 3D printers will lead to a serious fall on the trade of finished and semi-finished goods throughout the world, and a rise in the demand for the trade of raw materials instead. This can have determining effects on the container and bulk shipping segments. Moreover, other segments of shipping will be affected by the changes in the energy sector. Currently, about 87% of produced oil is processed and consumed as fuel products. Crude oil, petroleum products and other main fossil fuels (including coal, LNG, and LPG) constituted 40.5% of total international maritime trade in 2018.

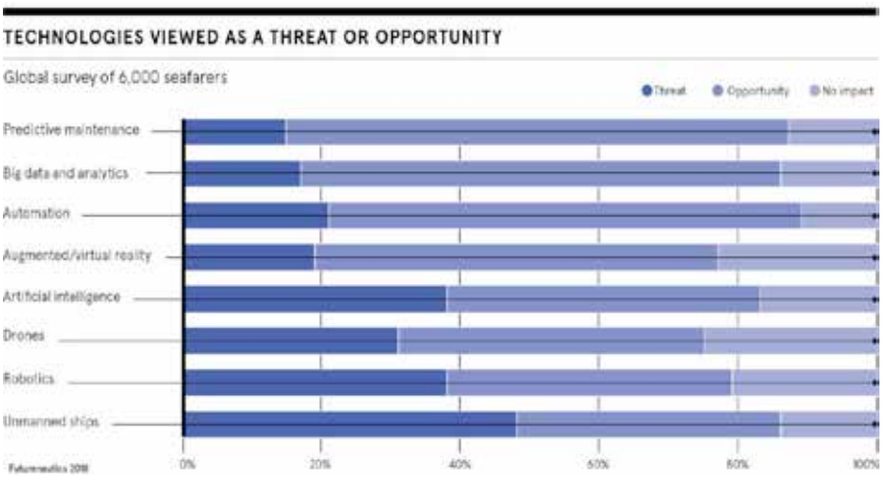
By widespread use of new energy supplies in the coming years (e.g. in cars, power plants, lighting industry, etc.), the demand for fossil fuels is expected to decline sharply and this can lead to a fall in the demand of the tanker and dry bulk segments. Another major trend that can alter the supply and demand in the shipping market is the development of competing modes of transport. This includes the development of rail transport networks, and more markedly the development of international Hyperloop grids in different regions of the world. This can erode the demand for merchant shipping especially by making land-bridges between countries in Asia and Europe. The level of decrease in demand will depend on the level of grid development and its effectiveness.

But on the other side, the 4th industrial revolution can also provide the maritime transport systems with major technological advantages to tackle the issues ahead. In order to sustain itself in the outburst of radical changes, the maritime transport systems are most in need of innovation, and mainly discontinuous innovation. We shall notice that after 'containerization' in 1960s, there has been no marked discontinuous innovation in the shipping industry,

and the improvements have been pursued by continuous innovations specifically in terms of developing more economy of scale and lowering the fuel costs. These innovation trends have proved to reach their utmost limits in recent years, and the industry needs breakthrough innovations to alter the architecture of its markets and its components (i.e. the competitive structure, the corporate capabilities, the production platforms, and the products of the industry). The 4th industrial revolution can provide the industry with significant opportunities in terms of technological improvements.

One major impediment to join to the mainstream of 4th industrial revolution is the commercial value and economic life of assets in the industry level. In 2019, the age of 79.25% of the capacity of the world shipping fleet was under 14 years, and this reveals that ship-owners concern any major changes that may incur enormous costs and/or postpone the utilization of the fleet. The other major obstacle will come from the labor force who will consider the technological developments of the 4th industrial revolution as a serious risk to their employment. This idea will be strengthened within the coming years and by actual deployment of new technologies in the maritime transport system. Although for some years, the machines will depend on human workforce to overcome their teething problems, soon a day will come that these systems can operate autonomously and with the least possible need to manning. In such days, the social resistance buildup among the labor force will be much stronger as they will have a clearer understanding of the new technologies and its impact on their work system.

In spite of all possible resistances, the signs of paradigm shifts indicate that change is inevitable: the challenging enforcement of new environmental requirements (e.g. the global sulphur cap, the Ballast Water Management Convention, the emerging ship efficiency requirements, etc.), and the irrelevance between supply and demand, as well as costs and revenues in shipping markets indicate the need for instant change. Within the coming years, the conditions will grow much harder in the maritime transport systems as the volatility, uncertainty, complexity, and ambiguity (VUCA) conditions will be strengthened under the synergies of 4th industrial revolution trends and the 3rd millennium challenges. On one hand in the coming two or three decades, the 4th industrial revolution is moving us toward a horizon of technological singularity where no



one can perceive the future afterwards it; and on the other hand the 3rd millennium challenges provide a gloomy perspective in which we can be the last generation to take the corrective measures to sustain human life on the planet. These forthcoming phenomena can have dramatic positive or negative synergies in terms of consequences like human's understanding of ethics, disruption of supply chains by natural disasters (or their protection), transforming patterns of labor and employment, famine or plenty of food supplies, pollution issues, and etc.

It seems that the best choice for shipping industry is to surf on the waves of opportunity that are generated by the 4th industrial revolution in order to pass over the 3rd millennium challenges. These waves can provide the momentum to learn, innovate, improvise, and improve solutions in heading towards the vague and complicated future. Nevertheless, we should understand that such waves are temporary, unstable, transitional, and uncontrollable in their very nature. This means that you may invest your time, money and energy in developing a solution, and you may find it useless or obsolete within few years or even months. In this sense the shipping industry is in need of major developments and improvements in its organization and resources.

Maritime transport systems are in ample need to learning and innovation in the coming years. This means that the industry should organize effectively to manage the knowledge work in the system level. The needed knowledge work can be organized in terms of Research and Development (R&D), Knowledge Management (KM), Technology Management, Strategic Management, and so on. This means that the maritime firms shall plan to invest on developing gold collar jobs for specialists and other learning knowledge workers. Moreover, in order to attract the needed knowledge work to their maritime transport systems, many developed countries are already developing maritime clusters and boosting knowledge-based start-ups in their maritime communities. These communities are endeavoring to support technological entrepreneurship within them, as well as attracting useful technological entrepreneurship from the exterior. Among them one can point to Maritime Startup Germany, Pier71 scheme in Singapore, PortXL in Europe, and New York Maritime Innovation Center (NYMIC) in United States.

The Knowledge work in the industry can provide the maritime industry with many needed solutions in the coming years. The industry may source ideas, technological solutions, managerial solutions, and innovations from the insourced and outsourced knowledge work. These ideas, solutions and innovations can be used to shed some light into the pitch dark VUCA conditions that the maritime transport system shall enter into within the coming years. It is almost certain that those firms that refuse to ignite and use such light, no matter how big in size, will fall and annihilate somewhere in the nearing future.

IRAN TO COOPERATE WITH IMO FOR STRENGTHENING THE ROLE OF WOMEN IN MARITIME INDUSTRY

Kitack Lim, Secretary-General of the International Maritime Organization (IMO), expressed that the Islamic Republic of Iran makes a valuable contribution to realization of IMO goals. By participating at IMO meetings and contributing to the debates and technical discussion at the IMO, such as the technical meetings of the committees and subcommittees as well as other events and meetings, Iran has shown its commitment to be an active participant in capacity building projects.

The Islamic Republic of Iran has always tried to develop constructive cooperation with IMO. To discuss more on this issue, Marine innovation magazine has conducted an exclusive interview with Mrs. Mandana Mansourian, Deputy Permanent Representative to IMO.

Mandana Mansourian, Deputy Permanent Representative to IMO

The Islamic Republic of Iran has always been known as an active member in International Maritime Organization (IMO), would you please explain what measures has been taken by this country to play a prominent role in IMO?

The Islamic Republic of Iran has always been an active member in IMO. Accession to more than 30 conventions and protocols adopted by IMO as well as many guidelines can prove that how this country actively participates in this international organization.

Moreover, The Islamic Republic of Iran is among the top 15 countries in terms of submitting technical documents to IMO. This country has positive and colourful presence in all IMO committees and subcommittees meetings. In addition, as a member of the IMO, Iran maintains a permanent representative in London.

The Islamic Republic of Iran has also shown its strong presence regarding technical issues, for example, at the time of approving amendments to STCW convention which is known as "The 2010 Manila amendments to the STCW", it was one the most influential countries that submitted 43 documents. The members of IMO always appreciate the Islamic Republic of Iran's strong cooperation regarding Manila Amendments.

Accepting Iran in STCW Convention's White List and maintaining this position for consecutive years is also another indication which implies that this country has a considerable role in IMO.

At the present time, how do you evaluate the level of cooperation between Iran and IMO? And what joint and direct cooperation are there between Iran's Ports and Maritime Organization (PMO) and IMO to facilitate and improve maritime processes at regional and international level?

With regards to Iran and IMO cooperation, I should state that The Islamic Republic of Iran has taken advantage of technical support of IMO in various areas and also has provided assistance to this organization. In fact, there is a mutual cooperation between Iran and IMO.

By offering educational courses and technical workshops, IMO has made a huge contribution to all member states including The Islamic Republic of Iran in the way of enforcing conventions.

Moreover, by providing short-term and long-term scholarships, IMO has taken a big step in training experts and staffs of country's maritime sector. It is worth mentioning that for mandatory audit of all Member States, IMO has used experienced

Iranian auditors.
Additionally, in many educational courses which are held under the title of Indian Ocean MoU, IMO has taken and will take advantage of Iranian experts as the teachers of the courses. The Islamic Republic of Iran has always tried to participate effectively in the activities of IMO.
Iran's representative to the IMO has played a very considerable role regarding the guidelines on transfer of technology and enhancing energy efficiency in ships as well as preparing the content of MOU between countries for technology transfer and technical cooperation under Annex VI - Regulation 4.
Two years ago, Iran's representative to the IMO was selected as one of the heads of strategic group to investigate the barriers to implementing IMO convention and protocol regarding dumping of wastes at the sea, she also has been appointed as vice-chairwoman of IMO's Technical Cooperation Committee since 2019.

In recent years, the Islamic Republic of Iran has been placed on white list of IMO, how this achievement has been obtained?

As you are well aware, IMO maintains a "White List" which is a list of member states who have confirmed to the IMO's Maritime Safety Committee (MSC) to be following the relevant provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, (STCW). Moreover, IMO holds white list of regional Port State control (PSC) MoU.
As I mentioned before, the Islamic Republic of Iran has been leading in implementing IMO conventions including STCW Convention. In addition, with regards to offering education courses for seafarers and monitoring maritime education centres, this country has spared no effort.
The Islamic Republic of Iran has successfully passed all international audits. based on these valuable performances, Iran has been placed on white list of IMO containing member states who have implemented STCW convention precisely and effectively.
Given that Iran enjoys a very young fleet and is continuously being monitored and controlled by highly skilled officers and experts of Iran Ports and Maritime Organization (PMO), its vessels has minimum deficiency while going under inspection of Port State Control in foreign ports.

Empowering Women in the Maritime Community" has been selected as the World Maritime Day theme for 2019, what practical measures has been taken by IMO to realize this ambitious goal? What role has Iran played in this regard?

Each year, IMO celebrates one day of the last week of September as International Day of the Seafarer. Day of the Seafarer provides an opportunity to pay special attention to three main objective of IMO; improvement of maritime safety, security and protection of marine environment. IMO announced that the theme of World Maritime Day 2019 will be "Empowering Women in the Maritime Community". IMO is calling on everyone in the maritime world to get on board with theme of gender equality.
Since IMO is a specialised agency of the United Nations responsible for maritime affairs, the theme of World Maritime Day 2019 is in line with Sustainable Development Goal 5, in other words, SDG 5 - Gender equality.
IMO is one of the leaders among specialised agencies of the United Nations which launched a global program with the title of "to attract more women in the maritime industry". Moreover, this international organization considered the issues of training and providing equal job opportunities for women in policies and decision making processes.
IMO has passed resolutions to access to maritime training and equal employment opportunities for women in the maritime sector.
More than 30 years
have passed since the launching of global program known as the "Integration of Women" in the maritime sector, and it still continue.
Integration of Women in the maritime sector is a global program that has pursued by IMO and not only includes women seafarers but also covers all women who are engaged in various land-based positions in the maritime industry.
In his speeches, Kitack Lim has highlighted that maritime world needs all hands on deck, both male and female. IMO believes that intrinsic differences between males and females as well as knowledge differences will result in further efficiency and progress in the industry. When the issue of absorbing women in maritime industry is raised, it means that we give special attention to three principles; training, recognition and visibility.
IMO strongly believes that it is necessary to provide women with appropriate training opportunities; they should take different positions particularly management positions. Taking an approach is needed to enhancing the contribution of women as key maritime stakeholders. We should value and recognize the significance of their works.
IMO is trying to fill this gap in the maritime industry through programs such as women in maritime industry maritime, workshops and different seminars. In addition, through inviting Member States to consider voluntarily donating to Technical Cooperation Fund, IMO has put offering specialized training for women on its agenda.
It is worth noting that Iran plays the most prominent role in this regard. As the first Iranian woman, I am honoured to serve as Iran Ports and Maritime Organization (PMO)'s representative at IMO and deputy permanent representative of Iran to IMO. This firmly confirms that Iran is committed to IMO slogan and objectives.
In 2019, I actively presented in all IMO programs which aimed at promoting and empowering of women in maritime industry. I was recognized by IMO as one of the distinguished, influential and competent woman among all women agents. It is necessary to mention that with the cooperation of IMO, we have programs for training, presence and further taking advantage of the potential and capacities of women in Iran's maritime industry.

FLEET GROWTH NEED TO BE HANDLED WITH THE UTMOST CARE

On the one hand, global geopolitical risks, trade and economic policy risks have resulted in the ambiguity and uncertainty of the market, on the other hand, rising trade tensions and air-emission control regulations are contributing factors to the market turmoil. In order to discuss more on this issue, Marine Innovation magazine has conducted an exclusive interview with Mr. Peter Sand, chief shipping analyst at BIMCO.

Peter Sand, chief shipping analyst at BIMCO

Container shipping market is suffering from imbalances and pressures on rates from trade tensions and new air-emission control regulations, would you please explain about this?

From the fundamental perspective, global shipping demand has grown by just 1% in the first nine months of 2019 against a fleet growth of 3.4%. Liner profitability is surely under pressure and cost cutting initiatives remain high on everyone's agenda in order just to break even.

The global economic slowdown is putting a lid on demand growth and the US-inspired trade wars are only making a bad year worse. Liner shipping is a global facilitator economic advancement throughout the world, and barriers to trade in whatever form they take, are hurting us all.

Going into 2020, the IMO 2020 tighter Sulphur regulations makes most liners fuel costs go up. It's essential for the carriers to pass on this extra cost to the shippers – down the supply chain. The shipping industry is unable to shoulder such massive cost, and should not do so. The bill should be picked up by end-consumers of the goods carried.

How do you evaluate global container port throughput in 2019 and what is your prediction for 2020?

Across the globe container throughput has been weak in 2019, for 2020 BIMCO's expectations are like this. If no significant easing of trade tensions takes place demand will remain subdued as it will weight on global economics too. Liner financial will struggle more in 2020 then, as the fundamentals weaken. Should trade tensions ease, they may become strong enough to match fleet capacity growth which we see around 3% for the next year. That would bring liners into a better position for passing on the higher fuel costs. A complete turn-around where demand growth exceeds supply for 2020 seems unlikely.

How will Digitalization and automation transfer skills requirements in shipping?

Much work goes into harvesting advancements from technology nowadays, for shipping this goes especially within the liner business. Plenty of benefits in easing the hassle of bookings, but I think is relevant also to look at the limitations. It will not revolutionize the business but surely evolve it. As shipping is a derived the demand of underlying global economics, it may impact the industry at larger scale,

BIMCO expects a trade-to-GDP multiplier for the liner business around 1 for the medium term future

how the manufacturing industry is taking onboard technology, in any form it may come.

The point I am making here is that shipping does not generate its own demand simply by existing. Shipping is a service to shippers. For the container shipping industry shippers rely heavily on the output from the manufacturing sector. Globalization has moved much production to low-wage countries in the Far East. If the manufacturing sector goes in the direction of using robots to a large extent for production, than will shift production location back to the countries where consumption actually takes place (Europe and North America). This will reduce the demand for shipping services IF that happens fast and at high pace.

What is the world maritime trade and ocean-based economy outlook?

Globalisation has become slowbalisation, which means slower growth that what we have seen in the past decade. With trade war raging, we sink deeper than we otherwise would. This is bad for shipping and all involved parties. Eventually, the trade war will either get resolved, or become the new normal. If the latter happens, future demand growth will be lower than if the former happens. BIMCO expects a trade-to-GDP multiplier for the liner business around 1 for the medium term future. In order to bring profits back around, fleet growth need to be handled with the utmost care.

BUMPS AHEAD FOR MARITIME TRANSPORTATION

The monthslong efforts which have been made to resolve the US-China severe trade dispute, has finally reached a dead end. Simultaneous with holding G7 summit, the two countries imposed new tariffs on each other's products; this means that the trade war has become a full-fledged war.

Previously, having the hope to ease tensions between US and China and increasing financial liquidity in China's economy, have put the analysts' pen toward promising statistics, but recent events including rising trade tensions, slowing Chinese economic growth, intensifying the risks of business policy, increasing the tendency of protectionist policy and preserving domestic productions once again cast a shadow on optimism about market recovery. The trade volume between these two largest economies has declined by almost 15 percent, since the second round of increasing tariff in September 2018.

About two percent of the world's maritime trade is affected by the US-China trade war, analysts said.

One of the important contributors to the slowdown in global economic growth is the US-China tariff war, according to the latest IMF report.

According to the National Bureau of Statistics of China, China's Gross Domestic Product (GDP) growth reached 6.2 percent in the second quarter of this year. China's

Geopolitical uncertainties, secular stagnation in some emerging markets, and Brexit are all contributing factors to the market turmoil

economic growth in the second half of the year is expected to fall to around 6 to 6.1% rate.

Maritime shipping volumes grew only 2.7% to 11 billion tons last year; UNCTAD said. Geopolitical uncertainties, secular stagnation in some emerging markets, and Brexit are all contributing factors to the market turmoil. In 2019, the maritime shipping volume is expected to grow by 2.6%.

What is currently on top of the agenda is the 2020 Low Sulphur Fuel Law, which will be come into force in less than two months. As we approach to 2020, the more ship owners are sending their vessels for installing scrubbers; therefore, in spite of low level of demolition, the tight availability of tonnage will result in an active capacity reduction. As a result, there will be significant increase in freight rate during the last three months of the year.

It is expected that wind blows favorably for owners in the crude oil market in the last quarter of this year. Rising demand for crude oil tankers, increasing number of scrubber installation on the tankers, and thus reducing overall tonnage capacity, all of which leading to a positive market outlook. But the dark shadow of the trade war may upset the projection of improving freight rate.

Since the beginning of this year, 14 million and 300 thousand DWT of dry bulk vessel capacity has been sold for demolition, representing 44 percent decline comparing to the same period over the last year. But in spite of the lull in demolition market, owners' rush to comply with the 2020 Fuel Law and install scrubbers will interfere the expansion of the vessels' capacity. About 300 bulk vessels are to be sent at yards to be equipped with scrubbers; therefore, the growth in tonnage supply would decrease and owners' hands to raise freight rates will definitely be more open.

More than 100 container ships are out of service and are being sent off to scrapping yards. More than 500 containerships are scheduled for installing scrubbers over the coming 12 months. The growing demand of ship owners to send tonnage to yards means reducing the container ships capacity, which minimize the effect of the quiet period of demolition market.

According to the Clarksons Research Group, in the first six months of 2019, the upward trend has continued in the tanker shipping market, while the dry bulk was performed quite disappointing in the field and the container shipping market does not look too bad.

UNCTAD reported; the bulker market during the first half of 2019 was a huge disappointment due to severe seaborne trade disruptions. The seasonal first quarter downturn was increased by the impacts of the Brumadinho dam rupture at Vale's mine in Brazil and subsequently adverse weather in the northern parts of Brazil and in Australia's Pilbara iron ore region. As a result, iron ore seaborne trade experienced a 4% decline compared to the same period last year.

The average of the BDI was 26% weaker than the first six months of 2019 compared to the second half of 2018. Following the drop in freight rates, the demolition of older tonnage at yards was accelerated. So that four million and 500 thousand DWT were demolished which is almost doubled comparing to the first half of last year. Despite the high activity in demolition market, stronger pace of delivery resulted in expansion of the fleet by 2.5% year-on-year.

Generally speaking, following the decline in active vessel capacity as a result of sending tonnage to yards for scrubber installations, freight rates are more likely to increase in the last quarter of the year compared to the first half of 2019.

On the whole, containership market conditions saw some degree of progress in the first half of 2019, but, with the exception of vessel earnings. Owners in the container market witnessed a difficult first half; spot box freight rates generally trended downwards, though started

It is important to highlight that based on latest forecast published by Drewry, the freight rates in tanker market will be higher in 2020, however, this trend will not continue after 2020.

to stabilize towards the end of the second quarter.

In terms of fundamentals, global seaborne container trade growth appeared relatively soft in the first six months of 2019. World economy fluctuations and escalating US-China trade war had an impact on container trade growth and projections have been downgraded. Container trade growth is now expected to reach 3.4% in TEU terms, although significant risks remain and further downgrades are probable, according to clarksons.

On the supply side, growth is now clearly slowing. Total fleet capacity expansion has stood at 1.8% percent since the beginning of this year; besides a slower pace of deliveries, it is likely to reach 2.9% and 3.2% for the whole of 2019 and 2020 (this number was reported to be 5.6% during 2018).

Crude oil tanker recorded significantly stronger earnings in the first half of this year in comparison with the very weak earnings in the first half of 2018. Clarksons estimated that the earnings of a giant oil tanker on the main route to the Middle East - Far East route were 146 percent higher than in the same period last year. In the first half of this year, Suezmax and Aframax earnings increased by 117% and 91%, compared to the similar period of 2018. The crude oil tanker market is expected to perform much beneficial this year in comparison to 2018.

It is important to highlight that based on latest forecast published by Drewry, the freight rates in tanker market will be higher in 2020, however, this trend will not continue after 2020.

In recent years, there has been a steady trend in world trade growth -but the growth has been slowed comparing to the last decade before the 2008-2009 financial crisis. However, it should not diminish the strategic function of maritime transport and its 80% share in global merchandise trade.

More significantly, in recent years, developing countries have been emerged as key players in the global economy both in trading

and shipping system. In fact, developing countries assumed to take the highest share in the volume of goods loaded and unloaded in ports.

The other side of the coin is the fact that some factors can limit Global maritime trade. The most important of those are the rapid wave of digitalization, increasing global efforts so far to mitigate climate change and energy transfer. Concerning environmental sustainability, an important and urgent concern is the implementation of fuel oil on the board with a sulphur content of no more than 0.5% on 1 January, 2020. The law will have significant consequences for maritime transport industry, ship owners, tanker trade flows as well as sea business.

Facing huge uncertainty, predicting the future of the shipping industry and the maritime trade is certainly not an easy task. But in general, UNCTAD considers that the growth of maritime trade will be continuous. The compound annual growth rate of CAGR is estimated to be 3.8% over the 2018-2023 periods.

In addition, the compound annual growth rate of CAGR for dry bulk commodities such as coal and iron ore is predicted to be 4.9%. Container shipments are expected to experience a compound annual growth rate of 6 percent.

It is hoped that the positive global macro-economic situation, China's strong demand for dry bulk cargo imports, fast growth of containerized trade, especially within the regions and outside the major East-West trade routes, will help to project the growth.

Moreover, the compound annual growth rate of 1.7 percent is estimated for crude oil; while oil and gas products are expected to reach a compound annual growth rate of 2.6 percent.

Efforts for regional and bilateral free trade agreements, low-cost manufacturing activities from China to other neighboring Asian countries, and major infrastructure development projects, such as the China's One Belt, One Road initiative, are among the factors that project the growth.

But at the same time, the bitter truth of global geopolitical risks, trade and economic policy risks results in the ambiguity and uncertainty of the market and shades our positive future perception.

But in general, UNCTAD considers that the growth of maritime trade will be continuous. The compound annual growth rate of CAGR is estimated to be 3.8% over the 2018-2023 periods

PORTS WILL CONTINUE TO DELIVER PROSPERITY IN THE WORLD

In order to delivering high performance and improving operations management, ports are moving toward smart technologies. Using these technologies will pave the way for enhancing energy efficiency which helps to mitigate environmental impacts. However, with the emergence of new technologies, there is a great potential for Cyber Attacks, which by targeting ports, will have adverse effects on the economy. Based on this, ports must address cybersecurity as a top priority. Marine Innovation magazine has conducted an exclusive interview with Dr. Masahiko Furuichi, Secretary General of the International Association of Ports and Harbors (IAPH). In the following, you will find the answers.

Dr. Masahiko Furuichi, Secretary General of the International Association of Ports and Harbors (IAPH)

How will smart ports make contribution to reducing air pollution and enhancing energy efficiency and sustainability?

A Smart Port is a port that uses automation and innovative technologies including Artificial Intelligence (AI), big data, Internet of Things (IoT) and blockchain to optimize the flow of traffic and goods within the port. A smart port is connected electronically with its stakeholders – shipping lines, port users and other logistics service providers, which puts itself in an ideal and favorable position to share and exchange data and information with them on a real-time basis toward addressing and solving common environmental issues such as reducing air pollution. To achieve sustainable economic growth, a smart port is required to be efficient and productive in its use of land property and energy and to provide its services efficiently to its customers as a link in the global supply chain. In other words, a smart port must always ensure a perfect balance between environment and economy, and it is a must, given ever-changing demands of global trade: ships are getting bigger, goods are moving faster, and geopolitical conflicts increasing here and there in the world.

What measures has IAPH taken to address and tackle a wide range of environmental issues such as greenhouse gas (GHG) emissions?

IAPH has a track record of actively supporting environmental sustainability through its own program "World Ports Sustainability Program (WPSP)". Originally started as the "World Ports Climate

Initiative (WPCI) to address emissions in a port area in 2008, WPSP now aims to enhance and coordinate future sustainability efforts of ports worldwide and foster international cooperation with partners in the supply chain, guided by the United Nations SDGs (Sustainable Development Goals).

We also work on the issue of GHG emissions closely with the IMO (International Maritime Organization), the UN specialized agency, the regulator for cleaner oceans and greener shipping in the world

We are not alone in addressing this critical issue, as the American Association of Port Authorities (AAPA), the European Sea Ports Organisation (ESPO), the International Association of Cities and Ports (AIVP) and the World Association for Waterborne Transport Infrastructure (PIANC) signed up as strategic partners of the WPSP.

We also work on the issue of GHG emissions closely with the IMO (International Maritime Organization), the UN specialized agency, the regulator for cleaner oceans and greener shipping in the world. Quite recently IMO highly praised one of WPSP's pillars – ESI (Environmental Ship Index) where

seagoing ships performing better in reducing air emissions than required by the current emission standards of the IMO are identified and rewarded with reduced port dues. In IMO's words, it is a perfect example of voluntary cooperation between the port and shipping sectors to contribute to reducing GHG emissions from ships.

Considering the accelerating pace of digitalization, how could we reduce the threats and risks of cyberattacks in ports operation?

We are fully aware of cyber resilience to increase the security of ports and harbors to better manage Cyber Attacks that frequently happen here and there in the world. It poses a grave danger and threat not only to ports and harbors but also to the entire supply chain, and it is something that we cannot do on a stand-alone-basis.

To strengthen global collaboration on cyber resilience and response, we are now working on a proposal to form and lead a cybersecurity network of chief information officers at several leading ports in the world. The proposed network would aim to enhance cybersecurity awareness in the maritime sector and facilitate early sharing of cyber threat information.

We will meet in Antwerp, Belgium, March 2020 for our annual conference, where we will discuss the issue for sharing best practice.

How do you predict ports throughput in the coming years?

I cannot predict about the future by looking into a crystal ball, but I can say, at best, that ports throughput will continue to increase in the coming years. In fact, UNCTAD expects in its latest publication "Review of Maritime Transport 2019" that international maritime trade to expand at an average annual growth rate of 3.5 per cent over the 2019–2024 period.

More than 90% of international trade is carried by sea, and I am confident that ports will continue to deliver prosperity in the world.

The proposed network would aim to enhance cybersecurity awareness in the maritime sector and facilitate early sharing of cyber threat information

CONTAINER THROUGHPUT IN 2019

Throughout the world, Container ports are experiencing the transportation of millions containers worldwide annually. A key factor to reduce trade costs is port performance. Each increase in port throughput will lead a rise in

According to the liner shipping connectivity index (LSCI) developed by UNCTAD, 5 of the top 10 most connected economies are in Asia, 4 are in Europe and 1 is in North America

GDP. Since, low connectivity makes trade costly and uncompetitive, well-connected container ports would play a considerable role for lowering transport costs and improving international competitiveness.

Given the significance of determining container port performance, The United Nations Conference on Trade and Development (UNCTAD) developed port Liner Shipping Connectivity Index (LSCI).

According to the liner shipping connectivity index (LSCI) developed by UNCTAD, 5 of the top 10 most connected economies are in Asia, 4 are in Europe and 1 is in North America. The Shanghai port has occupied the top position in UNCTAD's 2019 ranking of the world's best-connected ports**.** This port managed to get a connectivity score of 134 points in port LSCI, followed by the ports of Singapore (124.63 points), Pusan (114.45 points) in Korea and Ningbo (114.35 points), also in China.

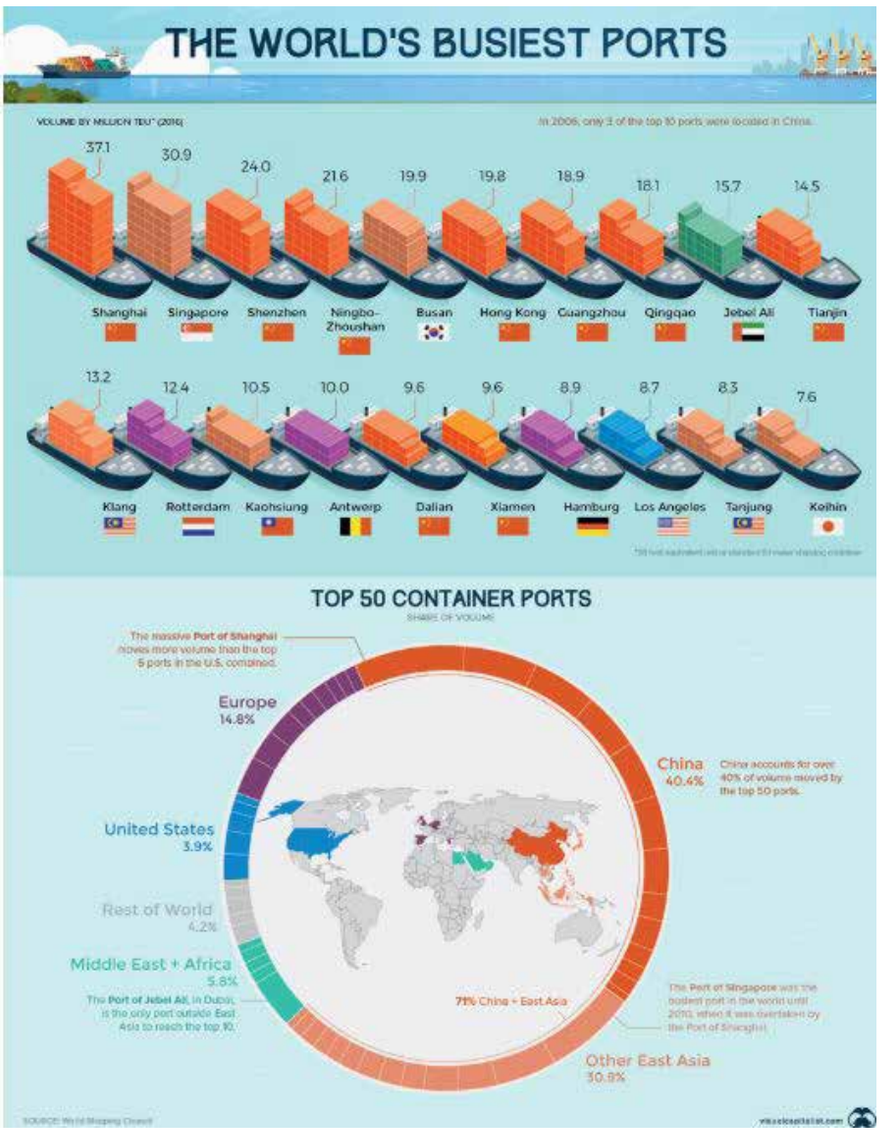
Besides the Asian ports, the other ports on the top 10 list are those of Antwerp (94 points) in Belgium and Rotterdam (93 points) in the Netherlands. None of the ports in the top 20 list are from Africa, Latin America, North America or Australasia.

It's worth noting that Piraeus (Greece), operated by COSCO (China), has become the best-connected port in the Mediterranean in 2019.

Based on the released statistics, Global container port throughput witnessed a 4.7 percent increase in 2018, down from 6.7 per cent in 2017. Overall, 793.26 million TEUs were handled in container ports worldwide in 2018 which indicates an additional 35.3 million TEUs over 2017. Lloyd's list noted: BOX volumes at the world's top 100 container ports reached 616.7m teu in 2018, representing an increase of 4.8% year on year.

Alphaliner reduced its global container throughput growth projection from 3.6% to 2.5% to 2.5 percent this year, as International Monetary Fund's downgraded its prediction about global gross domestic product growth from 3.3 per cent to 3.2 percent as well as Lloyd's List reported a decrease in trade volume growth from 3.4 per cent to 2.5 per cent.

Drewry reported: In August 2019, the global container port throughput index declined to 133.8 points, after reaching an all-time high of 134.8 points in July 2019. A lull in August was seen last year too. How-



It is predicted that if the threat of trade wars and protectionism dissipates, and the global economy enjoys a period of stable growth, world port throughput would reach 1.37bn teu in 2025, 35.4% over last year

ever, the August 2019 figure was 3 points higher than in August 2018 (representing 2.3% growth) and nearly 11.8 points up on the August 2017 figure of 127 points.

The analysts of Drewry believe that global container port demand continue an upward trend in the next five days and would reach 973m TEU by 2023. However, some analysts like Remco Stenvert and Andrew Penfold believe that "The container port and terminal business faces greater uncertainties now than at any time since the container revolution started in the late 1970s". Therefore, future investment by operators and investors will need to be more carefully considered than ever before.

They predicted that if the threat of trade wars and protectionism dissipates, and the global economy enjoys a period of stable growth, world port throughput would reach 1.37bn teu in 2025, 35.4% over last year, when global volumes edged past the 1bn teu mark for the first time, and further growing to 1.7bn teu by 2030.

Here are the world's 20 largest ports;

As you can see in the figure, among the top 20 ports in the world, just 5 of them are located outside of East Asia.

In the first half of 2019, Chinese port throughput volumes (all cargoes) presented an increase of 7.3 percent compared to the same period in 2018, according to the latest official Chinese data.

Figures from the Maritime and Port Authority of Singapore (MPA) shows that from January to September, Singapore port handled a total of 7.54m teu of boxes, which indicates a 6.6 percent rise compare to 7.07m teu handled in the corresponding period of last year.

For ranking and monitoring how well the world's container ports are connected with liner services, Drewry developed a bespoke index of container port connectivity.

Table 3.1 displays the top 20 ports globally based on 4Q18 liner service data. In the first quarter 2019, there has been very little change, with the top 16 ports occupying the same position as last quarter in 2018. Beyond this, Hamburg and Le Havre have swapped places, Tanjung Pelepas has moved into the top 20 and Jebel Ali remains in the 20th spot.

Drewry Q1 2019 report highlighted that weak Chinese GDP growth is a significant factor for throughput outlook. China's growth was 1.5% in 4Q18 on the back of a series of weak economic data releases leading to mounting concern over weak demand. So, Global container throughput in 1Q19 was diminished to 3.2%, lower than 4Q18 due to weaknesses in demand and global growth outlook.

It is important to highlight that despite a slower volume growth on the Asia-Europe trade as well as rising trade and economic uncertainty, Europe's two busiest container ports posted an upward trend in this year.

Based on Rotterdam port website, this port handled 11.19 million TEU from January through September, which indicates a 4 percent increase in comparison with the same period last year. In terms of tons, Rotterdam throughput reached 240.7 mil-

Table 3.1 GLOBAL CONTAINER PORT CONNECTIVITY INDEX, 4Q18 (TOP 20 PORTS)

Rank 4Q18 (3Q18)		Port	Country	Region	Total number of mainline services	No. of trade routes served	Port connectivity index score
1 (1)	➡	Shanghai	China	Greater China	175	6	100.0
2 (2)	➡	Ningbo	China	Greater China	161	6	92.0
3 (3)	➡	Singapore	Singapore	South East Asia	143	6	81.7
4 (4)	➡	Busan	Korea	North Asia	107	6	61.1
5 (5)	➡	Yantian	China	Greater China	83	6	47.4
6 (6)	➡	Hong Kong	Hong Kong	Greater China	79	6	45.1
7 (7)	➡	Shekou	China	Greater China	79	6	45.1
8 (8)	➡	Qingdao	China	Greater China	70	6	40.0
9 (9)	➡	Rotterdam	Netherlands	North West Europe	67	6	38.3
10 (10)	➡	Port Klang	Malaysia	South East Asia	64	6	36.6
11 (11)	➡	Antwerp	Belgium	North West Europe	61	6	34.9
12 (12)	➡	Colombo	Sri Lanka	South Asia	59	6	33.7
13 (13)	➡	Kaohsiung	Taiwan	North Asia	58	6	33.1
14 (14)	➡	Xiamen	China	Greater China	55	6	31.4
15 (15)	➡	Savannah	USA	East Coast North America	53	6	30.3
16 (16)	➡	New York	USA	East Coast North America	50	6	28.6
17 (18)	⬆	Hamburg	Germany	North West Europe	47	6	26.9
18 (17)	⬇	Le Havre	France	North West Europe	46	6	26.3
19 (21)	⬆	Tanjung Pelepas	Malaysia	South East Asia	42	6	24.0
20 (20)	➡	Jebel Ali	UAE	Middle East	49	5	23.3

lion tonnes in the first six months of 2019, which is 3.4% higher than the same period in the last year.

In the first nine months of this year, Antwerp port handled 8.87 million TEU which shows 6.4 percent growth compared to the corresponding period in 2018.

This table shows that top 15 European container ports have presented strong throughout in H1 2019.

In addition to high volume growth, Abu Dhabi ports presented a strong operational performance in the first half of 2019.

It is worth mentioning that an upward trend in DP World throughput stemmed from robust growth in Asia. In the third quarter of 2019, DP World handled 17.7 million TEU across its global container terminals, representing a 1.1 percent increase in comparison with the same period in 2018. However, Jebel Ali (UAE) handled 3.6 million TEU in 3Q 2019, down -1.0% year-on-year.

From January to September 2019, container volume throughput in Khalifa port rose to 620,974 TEU, which indicates a rise of 82.4 percent compared to 1,135,021 TEU in the corresponding period in 2018.

According to UNCTAD report, in early 2019, the total world fleet stood at 95,402 ships, accounting for 1.97 billion dead-weight tons (dwt) of capacity. Bulk carriers and oil tankers maintained the largest market shares of vessels in the world fleet (dwt), at 42.6 per cent and 28.7 per cent, respectively (table 2.1). Carrying capacity grew by 2.6 per cent, compared with the beginning of 2018. The growth rate has been declining since 2011, except for a slight increase in 2017, and remains below the trend for the past decade.

Global terminal operators' equity based throughput league table

Ranking	Operator	Teu (m)
1	PSA International	60.3
2	Hutchison Ports	46.7
3	China Cosco Shipping	46.1
4	DP World	44.2
5	APM Terminals	42.8
6	China Merchants Ports *	35.1
7	Terminal Investment Limited (TIL)	26.5
8	ICTSI	8.9
9	Evergreen	8.5
10	SSA Marine	8.1

According to Lloyd's list, Singapore's PSA International is the top port operator in this year's rankings. The second and third place has occupied by Hutchison Port Holdings and China Cosco Shipping, respectively.

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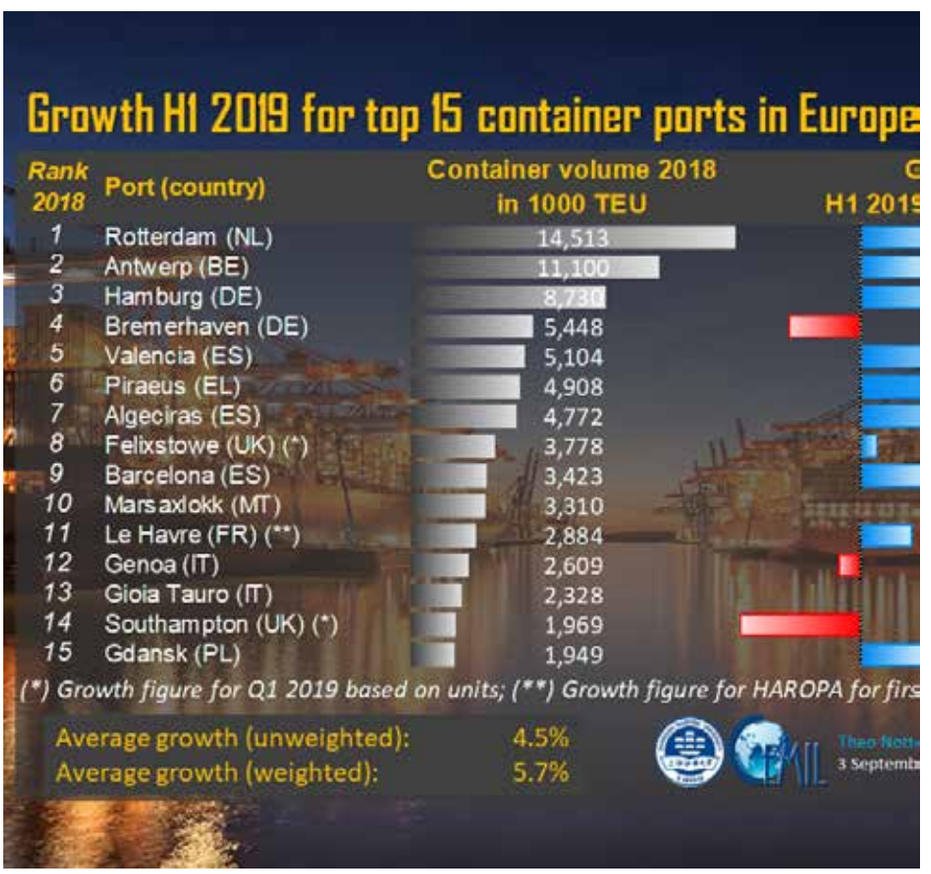

Khazar Sea Shipping Lines

Leader in Non-petroleum Exports

Liner Services

Bandar Anzali, Astara, Nowshahr, Feridon Kenar, Amir Abad Ports to/ from:

- Ports of Russian Federation (Astarakhan and Makhachkala)
- Ports of the Republic of Kazakhstan (Aktau)
- Ports of the Republic of Azerbaijan (Baku)
- Ports of the Republic of Turkmenistan (Turkmenbashi)
- Ports of Volga River
- Ports of Azov Sea
- Ports of Black Sea/ Russia, Ukraine, Georgia, Bulgaria, Romania and Turkey

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- Maritime transportation including shipment of ironware, grain, wood, industrial commodities, cement, ironstone, clinker, coke, general cargo, project equipment, container and automobile
- Providing regular shipping Lines to Import/ export goods and from Northern ports of the country to foreign ports of the Caspian Sea
- Providing competitive freight shipping rates
- Providing the best and easiest conditions for maritime transportation as well as issuing standard Bill Of Lading
- Offering free consultancy to owners to guarantee a reliable, fast and cheap transportation in the Caspian Sea
- Tax Exemption in freight rates of imported products by 10%
- Receiving freight rates of export cargoes by Rial
- Providing 20-40′ standard dry containers in all Iran's ports and foreign ports of the Caspian Sea
- Providing container shipping by Door-to-Door and Full LINER
- Shipping of 20-40′ dry containers through C.O.C and S.O.C by the owned fleet
- Providing cargo transit from ports of Far East to the Persian Gulf and CIS Countries and vice versa
- Shipment of cargo and oil products within the Caspian Sea
- Providing trans-regional cargo and oil products shipping as well as swap ship agency services

THE KEY MESSAGE TO GOVERNMENTS, SHIPOWNERS AND SHIP OPERATORS;

ENGAGE IN CONTINUOUS RISK ASSESSMENT

Maritime piracy is one of the greatest threats of working on the sea and the contemporary challenges of the maritime industry. Fortunately, the number of piracy incidents has seen a steep decline in recent years and are at their lowest levels since the late 1990s. IMO provides assistance, to member states seeking to develop their own national or regional measures to address the threat of piracy, armed robbery against ships and other illicit maritime activities. Marine Innovation magazine has managed to conduct an exclusive interview with Ms. Tracy Peverett, Head of Maritime Security at IMO.
As well as providing secretariat support to IMO Committees, technical sub-committees and working groups, she is responsible for advising and liaising with IMO Member Governments, international organizations and non-governmental organizations on the facilitation of global maritime transport, maritime security, piracy and related issues.

Tracy Peverett, Head of Maritime Security at IMO

In recent years, which areas are susceptible to high incidences of maritime piracy attacks?
In 2019, 163 incidents have so far been reported to IMO as having occurred worldwide (as at 22 November 2019). The regions with the highest number of incidents are: 62 off West Africa (including three hijacked ships); 33 in the Malacca Strait; 28 in the South China Sea.
It should be noted that IMO makes a distinction between piracy, which occurs on the high seas, and armed robbery, which is within the territorial waters and under the jurisdiction of the sovereign state.
For comparison purpose, in 2018, 223 incidents were reported worldwide, as compared to 204 incidents reported in 2017, an increase of about 9% at the global level.
Based on the data received, the areas most affected by acts of piracy and armed robbery against ships in 2018 were West Africa (81 incidents), the South China Sea (57 incidents) and the Western Indian Ocean (Arabian Sea, East Africa, and the wider Indian Ocean) with 36 incidents.

The issue of piracy against merchant vessels poses a significant threat to world shipping, what measures are taken and will be taken by IMO to reduce these incidents?
IMO has taken steps in two ways.
Firstly, the Organization provides a forum for discussion among Member states with a view to developing and issuing approved IMO guidance to prevent incidents from happening and from being successful; as well as promoting and disseminating best practice guidance developed by industry and others.
Secondly, IMO works with Member States to develop their capacity to prevent and counter threats to port and maritime security through improved implementation of the international maritime security instruments and guidance. We

deliver technical workshops for port and maritime officials designed to highlight the importance of co-operation among different government departments and agencies with a focus on monitoring the maritime space, information sharing, and building countries' capacity to deal with incidents as they happen, e.g. through coast guard interdiction training. IMO also promotes the concept of civil-military cooperation in detecting, deterring and responding to maritime threats.

Particularly in waters off Somalia, IMO has been working to support countries in implementing the Djibouti Code of Conduct and Jeddah Amendment, which were adopted under IMO auspices. IMO assistance aims at developing capacity in the signatory countries to deal with maritime threats, including piracy/robbery but also drug trafficking, maritime terrorism, weapons smuggling, and human trafficking.

IMO has also been supporting countries to build their national capacity in west and central Africa, around the Gulf of Guinea, under the regional framework of The Code of Conduct concerning the repression of piracy, armed robbery against ships, and illicit maritime activity in west and central Africa.

Do new technologies such as digitalization and automation make a significant contribution to reduce maritime piracy incidents?

Certainly, some technologies can help coastal States to identify and track vessels, and so this can help to monitor the maritime space and identify which vessels may be acting illegally - and also to assist those which may be under attack.

Information sharing can also be improved through digitalization.

Sharing information about incidents which have occurred with ships can help other ships be more prepared.

Judging from the reports IMO have received, conventional ways of enacting counter measures through physical ship hardening measures to protect against piracy and armed robbery are effective to avoid piracy attacks and mitigate its damage. Human resources (e.g. good look-out on voyage and patrolling at anchoring) are also important to reduce the incidents.

In your opinion, 2020 will be a better or worse year regarding the number of incidents?

Although overall numbers of incidents show signs of decreasing in recent years, certain hot spots persist around the world, and unfortunately crimes committed in some areas, e.g. the Gulf of Guinea, too often involve innocent crew being taken hostage. This has been mitigated in waters off the coast of Somalia, but hostage taking is now an increasing risk in the Gulf of Guinea region, which according to statistics from the International Chamber of Commerce International Maritime Bureau currently accounts for almost 90% of crew taken hostage and more than 80% of crew kidnappings globally.

It is difficult to forecast how trends will develop. The key message to Governments, shipowners and ship operators, shipmasters and crew is that you must engage in continuous threat/risk analysis, and continue the diligent application of existing IMO guidance and the revised Best Management Practices (BMP) guidance as well as the new Global Counter Piracy Guidance and the updated guidance for protection against piracy and armed robbery in the Gulf of Guinea region (contained in MSC.1/Circ.1601 on Revised industry counter piracy guidance).

IMO also strongly encourages Member States to continue to provide naval assets; and advises flag States to continue to monitor the threat to ships flying their flag and set appropriate security levels in accordance with the IMO International Ship and Port Facility Security (ISPS) Code.

CONNECTIVITY, A PARTICULAR PROBLEM FOR SEAFARERS AND THEIR FAMILIES

Sandra Welch, the Chief Operating Officer for international maritime charity Sailors' Society

Providing a verity of services including emotional and financial support to sailors' families is a key issue and is regarded as a strong motivation for sailors to enhance their performance.

Connectivity on ships has revealed the emotional and operational impact on professional seafarers who are often away from home and have limited opportunities to interact digitally with families and friends. It reduces some of the emotional stresses that come with separation from families. Sailors' Society is an organization which makes a big contribution to meet the families' demand. Marine Innovation magazine has spoken to Ms. Sandra Welch, the Chief Operating Officer for international maritime charity Sailors' Society.

Leo said, "No words can describe how happy I am to finally meet, touch, carry, kiss and hug my little boy. To see his sweet smile for the first time is so ".precious

Over the years we have become increasingly involved in caring for seafarers' families and today we have a specific programme, wellness at Home, dedicated to supporting them

What measures have you taken to meet practical, emotional and spiritual needs of sailors' families all around the world?

We were established more than 200 years ago with the mission of supporting destitute seafarers, but we soon broadened our horizons to meet the needs of their families by raising funds for the widows and children of those killed at sea.

Over the years we have become increasingly involved in caring for seafarers' families and today we have a specific programme, wellness at Home, dedicated to supporting them.

Our chaplains continue to care for families when crisis hits, coming alongside them to find out how we can best help. Sometimes this is providing them with vital information about their loved ones – like liaising with the lawyers for seafarers who are wrongfully imprisoned and bringing their families the latest updates in the case.

We can also offer financial help, like the emergency grant we provided to the wife and children of a seafarer whose house burned down while he was at sea. And when seafarers have suffered a trauma, such as being held hostage by pirates, we prepare their families for what to expect when their loved ones return and how they can help them reintegrate into everyday life.

In all of these cases, just knowing that there is someone to turn to for advice or help can make a big difference for seafarers' families.

We also offer long-term support to seafaring communities badly affected by deprivation or natural disaster. Following the devastation caused by Typhoon Haiyan in the Philippines in 2013, we rebuilt homes, health centres and schools for seafarers' families – the most recent of which, an integrated school on the tiny island of Lipayran, is due to be completed this winter.

Families can face a high risk of poverty as a result of strained relationships and poor support systems, especially in the Philippines, where seafaring is a major source of employment. So we also support families there by running clubs to teach children important life skills and giving seafarers' spouses opportunities to improve their education, financial management and income through our Seafarers' Family Association.

We also provide free or affordable healthcare for seafarers' families

We can also offer financial help, like the emergency grant we provided to the wife and children of a seafarer whose house burned down while he was at sea

in deprived regions of India and Indonesia.

According to your research, what are the main challenges which sailors' families facing when the sailors are on board? How could we alleviate these challenges?

Seafarers can be away from home for up to a year at a time, which can have huge implications for the families they leave behind and place a great strain on family relationships.

Our Navigating Everyday Connectivities at Sea research with Inmarsat and Royal Holloway University of London, 2018, showed that connectivity can be a particular problem for seafarers and their families. Internet or phone access is extremely variable, depending on the ship and whether the employer gives Wi-Fi access to the crew. When seafarers are unable to access Wi-Fi, they may be unable to speak to their families for days or even weeks, so families can feel very distant from their loved ones.

The seafarers researched who did not have Wi-Fi access said it can be very difficult when they make arrangements to speak to their families the next time they are in port, only to face a delay, leading to disappointment on both sides.

Another challenge for seafarers' families is that weight of day-to-day responsibilities, such as managing the household finances, disciplining the children or caring for a sick relative, falls on the spouse at home. Even if the seafarer has good connectivity, long shifts and differences in time zones mean they're not always available to talk to – and there's a limit to what the absent partner can do from thousands of miles away.

If the seafarer disagrees with their partner's decision, this can be an additional cause of stress. Arguments between family members at home and the absent seafarer can be much harder to resolve because of the distance involved – it may be days before they are able to speak to each other again following a disagreement.

Employers can certainly make life easier for seafarers and their families by ensuring greater Wi-Fi access for their crews. Our chaplains also help by bringing free Wi-Fi hot spots to seafarers in port so that they can call home.

We can also empower seafarers' families to deal with the challenges they face by creating a strong community around them at home, helping them recognise why they are under pressure and giving them tools to cope.

Through our Wellness at Home programme, we support seafarers' families by helping them gain greater confidence in their decision-making and money management. We also support them financially with grants or training to ease financial stress. Another way we help us by talking to seafarers' spouses and children about what it is like for their loved one to work away at sea. This can help them relate better to the seafarer in their family and improve communication and relationships.

Considering the accelerating pace of new technologies in the shipping industry, how are you taking advantage of them to facilitate connection between sailors and their families?

Internet has been such a game-changer for seafarers communicating with their families and we're always looking for new ways to facilitate this, offering free connection in seafarer centres to bringing Wi-Fi hotspots on board ships. We're currently trialling these hotspots in the UK through a pilot programme funded by the Merchant Navy Welfare Board and ITF Seafarers' Trust.

Internet has been such a game-changer for seafarers communicating with their families and we're always looking for new ways to facilitate this, offering free connection in seafarer centres to bringing Wi-Fi hotspots on board ships

It's an incredible pleasure to be able to do this – seafarers are so thrilled to be able to connect with their families and we've even witnessed fathers seeing their babies for the first time online. It's also really valuable that when we take Wi-Fi on board it's in the hands of a chaplain, who is able to support the seafarer if they receive bad news when they call home.

Another way we use new technology is through our Wellness at Sea app, which gives tips and ideas for seafarers about how to manage their well-being. Families can also download the app to find out which port their loved one's ship is due to arrive in and when.

What plans do you have for the future?

We want to continue offering Wi-Fi to enable seafarers to connect with their families, and we also are looking to further develop our Ship Visitor reporting platform – a mobile app which enables organisations to plan, deliver and report on ship visits and port chaplaincy, offering continuity of care around the globe. To date, more than 775,000 seafarers have been visited by ship visitors using the app.

With funding from the ITF Seafarers' Trust, access to the app will now be freely available to all members of the International Christian Maritime Association. This will increase the welfare of seafarers around the globe.

Our Wellness at Home programmes for seafaring communities are expanding, both in the Philippines and in India, where we will be offering a number of free medical camps to seafaring communities in Kerala and Chennai.

Our Crisis Response Network is being extended to provide dedicated 24/7 helplines to companies which seafarers can contact for assistance in a crisis – be that a major incident at sea or a personal crisis.

These are just some of the ways we want to build on our 200-year history and offer care and support to the seafarers and their families who need us.

SEAS AND OCEANS; GLOBAL HERITAGE

Dr. Behrouz Abtahi, the head of Iranian National Institute for Oceanography (INIOAS)

Iran is a maritime country and its sailing history dates back to thousands years ago. Iranians have always had a strong presence in the sea. Throughout the history and even in recent years, Iranians are being recognized as leading people in both marine and sailing science, and for this reason, Iran is an active member of the IMO that plays a key role in determining the trends and strategies of this international organization. One of the reasons of this major impact can be found in the cooperative efforts involving Iranian government and nation in acquiring maritime knowledge, an obvious example of which is the establishment of the Iranian National Institute for Oceanography (INIOAS). This scientific research-based center is one of the most efficient arms of the Iranian maritime sector. Iran's large maritime fleet is known as the biggest shipping fleet in the region, including numerous large and small ports in north and south of the country which underline the need to monitor the marine environment. It has also provided the context for several private and

Iranian National Institute for Oceanography and Atmospheric Science (INIOAS)

There are three active research centers in the structure of the Institute including: Ocean Sciences Research Center, Ocean Engineering and Technology Research center and Atmospheric Sciences Research cente

public scientific research-based organizations and institutions to meet the needs of Iran's maritime sector. Meanwhile, because of its strategic importance, the Iranian National Institute for Oceanography as a public sector is under the control of the government and has close and effective communication with UNESCO and other international organizations. Since its establishment, the organization has met the demands of the Iranian maritime sector and has also carried out positive activities in the regional international level; most notably in the continuous monitoring of the marine environment of global strategic maritime zones such as the Persian Gulf, the Gulf of Oman and the Indian Ocean.

Due to the importance of the role of Iranian National Institute for Oceanography in the country's maritime domain, Dr. Behrouz Abtahi, the head of this research-based institute, who has a PhD in Marine biology (deep-sea ecology) from the Institute of Oceanography of Moscow, answered the following questions of Marine Innovation magazine.

First, when did the National Institute for Oceanography and Atmospheric Sciences start operating, and how is it working right now?

This institute was established in 1992 according to the agreement between the Ministry of Science, Research and Technology of Islamic Republic of Iran and UNESCO, more precisely, the Intergovernmental Oceanographic Commission of UNESCO (IOC). It was originally known as the Iranian National Center for Oceanography, in the second decade of its existence, it was renamed to "Iranian National Institute for Oceanography" and after about five years, subject to the approval of the Ministry of Science, Research and Technology, named as the "Iranian National Institute for Oceanography and Atmospheric Science ".

There are three active research centers in the structure of the Institute including: Ocean Sciences Research Center, Ocean Engineering and Technology Research center and Atmospheric Sciences Research center. There are also four other centers: National Oceanographic Data Center (NODC), Regional Education and Research Center on Oceanography for West Asia (under the auspices of UNESCO), National Center for Ocean Hazards (INCOH) and National Center for Antarctic Research (NCAR). INIOAS had established 4 research-based centers in the northern and southern coasts of Iran, operating in Chabahar, Hormozgan, Bushehr and on the northern coast (Noshahr).

What are the equivalent international organizations to the Iranian Institute for Oceanography and Atmospheric Sciences?

There are numerous institutes operating in the world, known as Oceanography and Oceanology institutes.

How do you communicate with these institutes?

Due to the wide range of these institutes, we are connected to a limited number of them, including research organizations in India, Oman, France, Germany, Russia, etc. We are good scientific coordinators which sometimes contributed to the joint projects. . Basically, in our country's research and technology system, international communication considers as one of the positive features and we are fortunate enough to enjoy.

What are the most important issues that you are dealing with in your international communications?

Climate change and its effects on ocean and marine environments are among the most important issues addressed in international cooperation with the National

Climate change and its effects on ocean and marine environments are among the most important issues addressed in international cooperation with the National Institute for Oceanography and Atmospheric Sciences

Institute for Oceanography and Atmospheric Sciences.

How is the result of this joint research projects being applied in practice?

Some outputs affect national decisions and the others have an effect on international decisions, for example the Paris international agreement regarding global warning. Part of this research focuses on decision-making in industries and other economic activities. Another part of this research will be used for environmental predictions for the world future. However, the results of international oceanographic and marine researches have many applications that can be widely applied.

The word "national" is used in the name of this institute which indicates its importance in Iran. Please explain how the National Institute for Oceanography and Atmospheric Sciences plays a crucial role in decision-making in the field of national, marine and environmental issues.

This research institute aims to develop interactions between related national and international organizations, because of which it has a national title and is trying to assume a role of leading authority over the country's oceanic studies, in which it has been successful. Currently the Iranian National Institute for Oceanography and Atmospheric Research is in charge for directing the Iran's Universities Union and Marine Research Organizations, being the Secretary of the National Oceanic Research and Technology Network, and the head of the Iranian National Committee on Oceanography.

The research-scientific productions of the National Institute for Oceanography and Atmospheric Science are being utilized in the field of navigation. How are you connected with the Ports and Maritime Organization and the shipping operators?

Ports and Maritime Organization as the country's maritime administrator needs scientific information and data to plan and make decisions of the rules and regulations which were dominant in Ports and Shipping Organization. INIOAS takes an active role in these research-based issues and is in contact with this organization. Fortunately, there are many private-sector research-based and consulting institutes in oceanographic fields that all provide reliable scientific data for all related organizations and centers. Iranian universities are also active in this field. The National Institute for Oceanography and Atmospheric Sciences cooperates with these scientific, research-based and service centers which will also address part of the maritime and shipping needs in related fields.

Your activities are very highly effective for marine environment. Would you explain more about this issue?

Environmental Research is always top of the INIOAS's agenda. The Institute's programs include the Coastal and Marine Monitoring Program. Most of our monitoring activities are in the fields of the impact of pollution on marine ecosystems and environment and the Department of Environment is also interested in these research-based activities.

As you mentioned before, the private sector is also highly active in oceanography, but does it have enough facilities, capabilities, and accumulation of knowledge to advance its scientific work?

They do not have the enough facilities to conduct deep-sea studies. But they have good facilities for coastal research and some monitoring devices which can be installed at sea. Therefore, most of the time, the private sector meets the needs of the universities' scientific studies. We have a national referral role in marine data, and the National Oceanographic Data

Center of INIOAS is internationally renowned. The Iranian National Institute for Oceanography and Atmospheric Sciences in the field of marine data at this level is currently responsible for setting up two offshore research centers in the Persian Gulf.

How have the brutal and unilateral sanctions of some countries that have violated international law affected your activities? In other words, if there were no sanctions today, the conditions for international cooperation wouldn't be better for the institute?

Scientific communication between professionals and people, who share the same theoretical knowledge, won't be easily influenced by politics. Since scientific communications are part of human and cultural relationships. Fortunately, the scientific and cultural links strengthen the relationship between nations, although politics does damage to this relation, it cannot undermine its nature. However, sanctions can interfere with scientific communication when communications require financial transactions. For example, it will cause problems supplying equipment, and this is one of the negative effects of sanctions. But Iran will not allow any obstacles to cause disturbances to its progress. If there were not the sanctions, the institute would have facilitate effective and easier communication with neighboring countries in order to share scientific findings with one another, while the Persian Gulf is one of the world's most important energy and economic waterways and as one of the world's most sensitive seas. Iran is among the world's top 10 countries in terms of the scientific growth, and according to UNESCO ocean

science report, China and Iran have had the highest-growth rate in oceanographic research in the last ten years. Iranian National Institute for Oceanography and Atmospheric Sciences is perfectly capable of providing other countries with high quality services but in some case sanctions create obstacles.

You said that Iran, along with China, has experienced the highest-growth rate in oceanography. What is the significant contribution that the Institute has made to this growth concerning Iran?

In order to identify the contribution; we need to have a look at the total number of researchers working in the field of marine science in Iran. There are many research-based institutes that do not operate under the auspices of the Ministry of Science, Research and Technology in the field of oceanography, including: Iranian Fisheries Science

Research Institute, Islamic Azad University and Ministry of Energy. All of these, together with the capabilities of the private sector, develop the country's oceanic scientific potential. The Iranian National Institute for Oceanography and Atmospheric Sciences has also played a leading role in the development of the country in the field of oceanography, in line with its scientific facilities and professional researchers.

How is the relationship between the INIOAS **and the universities?**

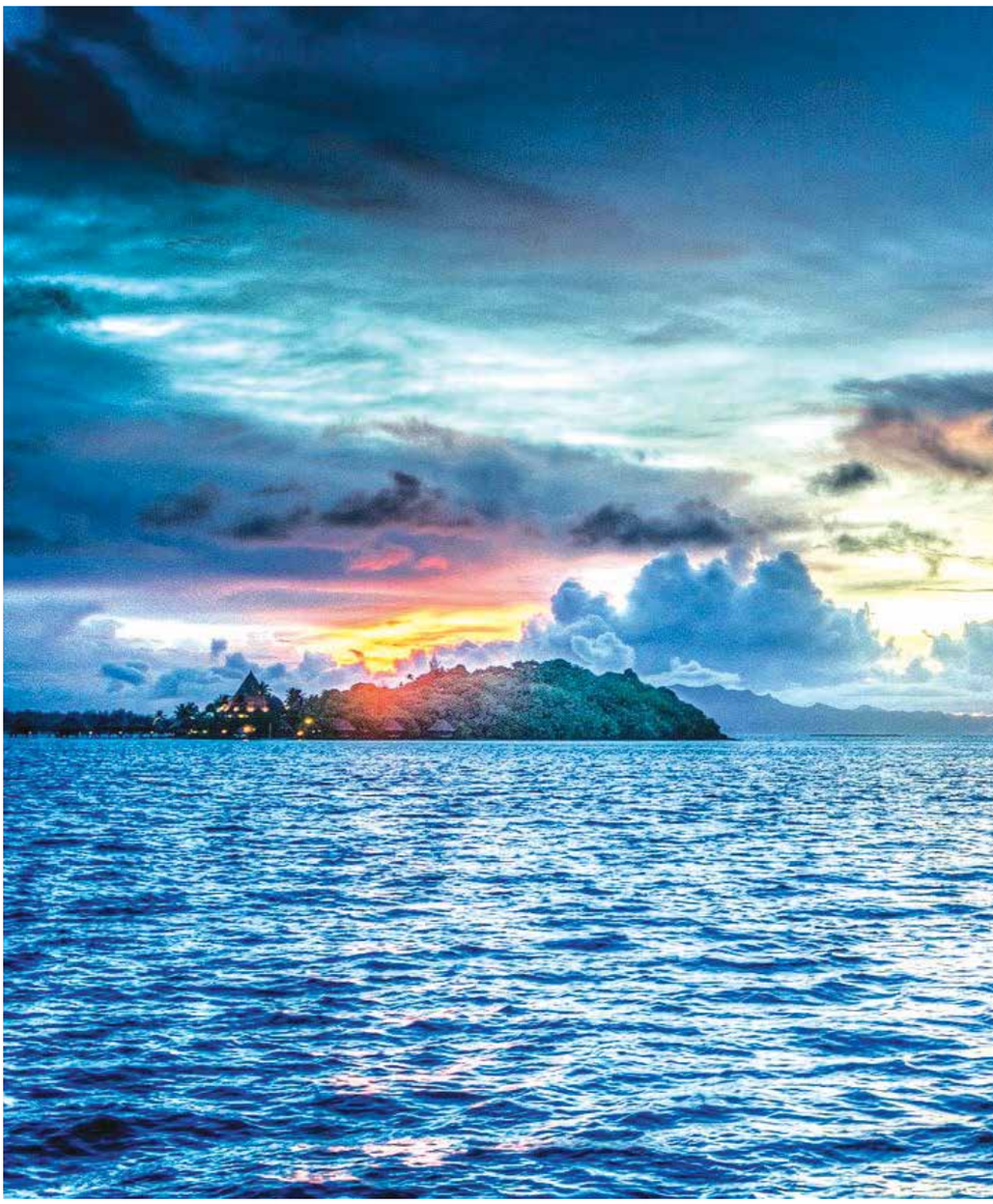
We try our best to provide our facilities to the universities. We have a very good correlation with universities on the coastal regions, including: Khorramshahr University of Science and Technology, Persian Gulf University, Chabahar Maritime and Marine University; as well as Northern Coast universities such as University of Mazandaran and Guilan, alongside the highly prestigious universities that are members of the Universities' Union and the Coastal and Marine Research Centers: AmirKabir University of Technology, Shahid Beheshti University of Medical Science and Isfahan University of Technology and Tarbiat Modares University.

How is your cooperation with international scientific organization?

- In the scientific field of study, INIOAS's mutual cooperation with international organizations is very effective and they have a good understanding of our capabilities.

What are the most important research projects being carried out by the institute currently?

Our most important projects are



macro science plans. One of these projects is monitoring the coastal region. Another is the Persian Gulf Floating Explorer Program. In this regard, last year, we carried out two oceanographic sampling across the Gulf of Oman. These data are used in the field of environmental studies, climate change and environmental monitoring and pollution examination.

Do you already have any primary data of this exploration?

According to the findings of the Persian Gulf explorer, the dissolved oxygen level is decreasing in the Sea of Oman like the other world's oceans, , due to the effects of human activity in the seas which is not only limited to the Sea of Oman.

Could you please give us more information about the Persian Gulf explorer?

The Persian Gulf explorer is the biggest oceangoing research vessel in the Middle East which is only designed for oceanographic survey. This vessel offers numerous applications in the field of

physical oceanography, marine chemistry, marine biology, geology, sea geophysics, professional climatology including atmospheric, meteorology and sea mapping in addition to the examination of the polluted situations in the seas. The vessel is well-equipped and capable of operating range of three thousand sea miles in the marine environment and has relatively modern advanced measuring equipment. The Persian Gulf Explorer provides a good opportunity to generate marine-based developmental data bases.

Finally, would you please make your final point?

We should take every possible opportunity to draw people's attention to marine-based development and the importance of preserving marine environment. Generally, marine environment looks like a large amount of water that facilitates commercial transportation. But recent experience showed that this environment is vulnerable. We have studied the various kinds of this vulnerability. We must, therefore, do our best to protect the beautiful marine environment in the north and south of our country. Part of action is up to governmental authorities and organizations and the other part depends on the people themselves. Seas and oceans are the world heritage and must be passed down through future generations. Negligence will cause a dangerous future as the amount of Marine debris will be more than the number of aquatic animal in the next thirty years.

AUTONOMOUS SHIPPING; PROMOTING SUSTAINABILITY, LOWERING COSTS, IMPROVING ENVIRONMENTAL FOOTPRINTS AND SAFETY

In an interview with Marine Innovation magazine, Mr. Robin T. Bye answered to the questions concerning new technologies and their impacts on the shipping industry.
Mr. T. Bye is an associate professor in automation engineering and the head of the Cyber-Physical Systems Lab at NTNU - University of Science and Technology in Ålesund, Norway. He is also an affiliated scientist at NTNU AMOS - Centre for Autonomous Marine Operations and Systems.

T. Bye, associate professor in automation engineering and the head of the Cyber-Physical Systems Lab at NTNU

It has been argued that the rapid growth of emerging technologies and innovations could shake the global maritime industry, would you please explain the issue?
Essentially, I think with a lot of data being available in real time, it is possible to make predictions and also to make adjustments to what you have planned. At the moment, a lot of data is available, however, it has not been fully utilized yet. For example, to predict maintenance, to know when something is going to breakdown, so you may take measures and fix something before it happens. For example, the data from an engine can be analyzed in real time, and perhaps you can be warned two weeks in advance before it breaks down, So, those kind of things are becoming more and more common.
Another thing is Autonomous ships, which is my focus at the moment. The same kind of development is seen in autonomous shipping. A lot of technologies exist but they have to be regularized, and the safety aspect is very important. I think regularization, law-making and the safety aspect will be one of the biggest hurdles to overcome before autonomous ships will make in impact in the market. Autonomous ships have the potential to have a big impact on sustainability and reduce costs, you could improve environmental footprints, you could improve safety because you do operations without requiring crew, and you can have ships specially

In new ships, we can install new technologies, hence they are better suited and more prepared for cyber security than older ships

designed for being unmanned, not requiring a lot of infrastructure such as kitchen, toilets, beds, etc. Hence, there is also great potential or radical new ship designs enable operations in harsh conditions and for a sustained period of time. Given the said hurdles relating to common international frameworks, laws and regulations, the technology will come faster than regulations.

Cyber security is extremely important, especially with current and older ships. You would have technologies on board that has been providing sensor data for long time but only to onboard data storage. These sensor units may not have been designed for being connected to the internet. Old devices that now get connected on the Internet, does not have preventive measures against cyber security. For new ships, this is not such a big problem, because you can design new equipment with the new era of Internet of Things in your mind. But for older ships, sensor data may have little security and may require cyber security mechanisms to be retrofitted.

With respect to cyber-security in general, I guess we cannot guarantee any device or system which is open to internet to be 100% secure. However, with current technologies in banks or other tech businesses driving cyber-security technology forward, I do not see the maritime domain as particularly easier or more difficult that other domains. In every business we have the same this problem, you can hack an airplane, a car or a ship. In new ships, we can install new technologies, hence they are better suited and more prepared for cyber security than older ships.

What changes will IoT and

There are a lot of advantages, with fully or semi-autonomous ships, it definitely opens up some opportunities, which could be very good for the environment

blockchain cause in the shipping industry?

One change we could see is that smaller ships or remotely-controlled ships without people on the board might become common. Hence our ships can be designed drastically different. At the moment, if we are removing crew, you are able to ignore infrastructures like toilets, sleeping rooms, foods, living rooms. You could make ships operate in a variety of conditions and areas for a long period of time. You do not have to send back crew on shore, and so on. So there are a lot of advantages, with fully or semi-autonomous ships, it definitely opens up some opportunities, which could be very good for the environment. Because you can put a lot of cargo ships on slow transits, which can be cost effective in terms of energy wise and because there is no crew to pay.

How could the maritime industry benefit from information technology?

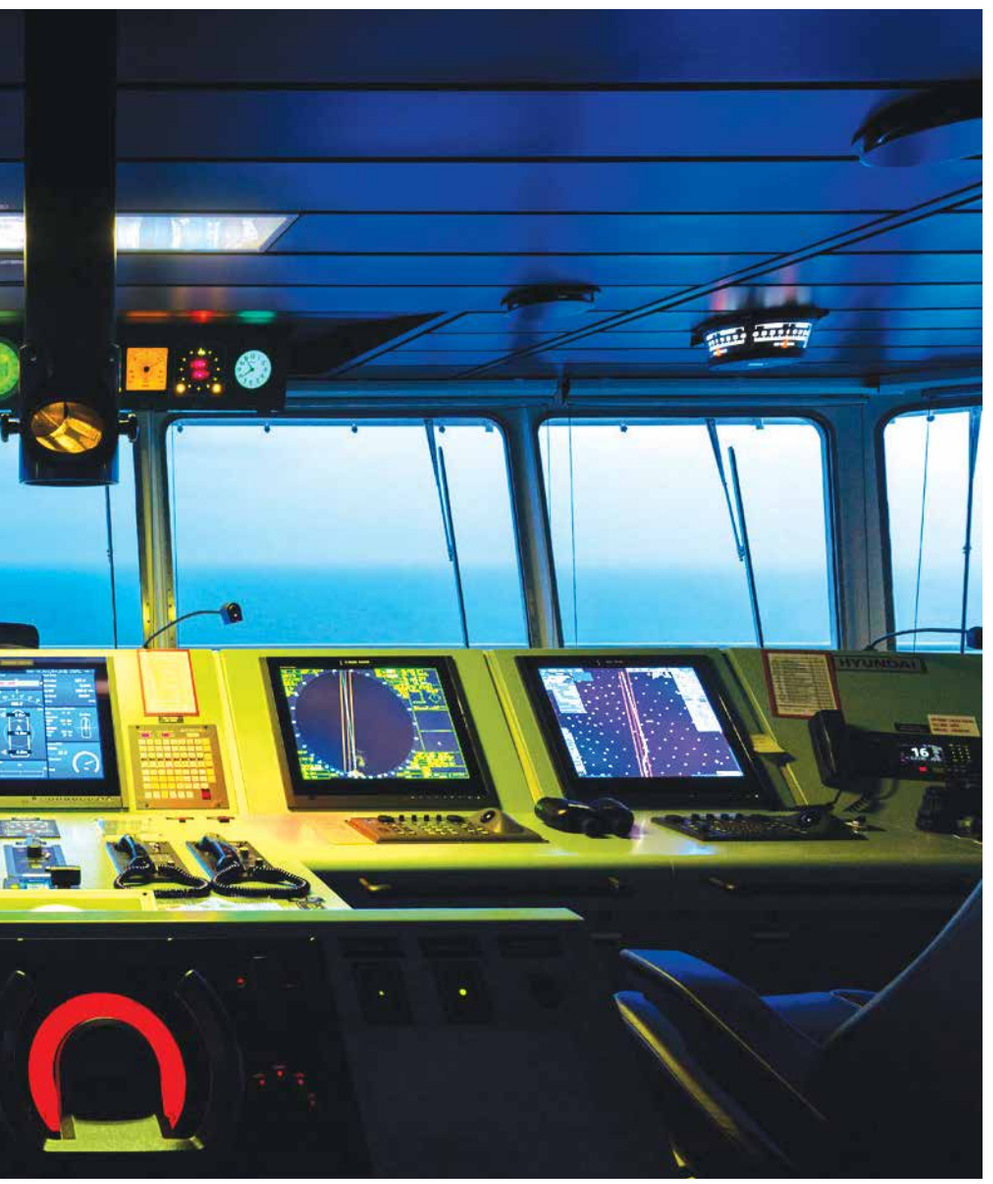
Currently, I suspect there is more data available than people are able to actually process and then use it. So I suspect that shipping companies are saving a lot of data, but they have only started to scrape the surface of what is possible to do with the data. They naturally try to work out for patterns or to predict something but I sense that these developments are still in their infancy. As I mentioned, for predictive maintenance you can look at data and work out before something happen, like breakdown of an engine, But you can also

predict patterns in different scales for example, high level logistics planning and strategic online fleet management for longer durations . So you can reschedule and make smarter operations, and if you have a fleet of ships, you could make use of intelligent algorithm and all real-time information available to make collective decisions for the fleet. The ships could be rescheduled to go to different ports, swap operations or missions, or stuff like this.

AI, machine learning, IoT open up some opportunities, chine learning algorithms are able to extract those features that are important to make cost -effective plans for example, you can save fuel, because you can predict weather conditions ahead of time and combined with mission data do collective preplanning of operations/missions.

Naturally, companies will always take measures to save money, be more efficient, etc. When technological revolutions have occurred, there can be immediate periods of layoffs, but in the longer run, new job descriptions arise, e.g. when manual work is being replaced by machines, manual workers can be trained to operate the machines instead.

In relation to the future, however, it may well be that enabling technology such as interconnecting cyber-physical systems and maritime IoT as well as progress towards autonomous and unmanned vessels, as mentioned elsewhere, this technology will have an impact on ship design. The reason is of course that unmanned vessels can be designed for different operations than today because humans and required infrastructure is no longer needed on board ships. This can reduce deadweight, induce radically new designs of hulls, and so on, to enable more cargo, slow but energy-efficient ultralong-haul journeys, harsh environments, etc.



In the light of new technologies and innovations, what is your general prediction for the future of shipping industry?

I think the future is bright. A lot of land traffic could be replaced by sea traffic. I think fully autonomous ships are further away than onshore control centres with remote control and decision-support systems are probably much closer It may be that for short distance transits, e.g. passenger ships/ferries in confined waters will probably appear before more general-purpose autonomous ships. A big challenge is agreement between different nations on common systems for integrating autonomous ship traffic, e.g. new standards like “AIS 2.0”, “COLREGS 2.0”, may have to be defined, in conjunction with laws and regulations.

JOINT COOPERATION FOR ECO-FRIENDLY DESIGN

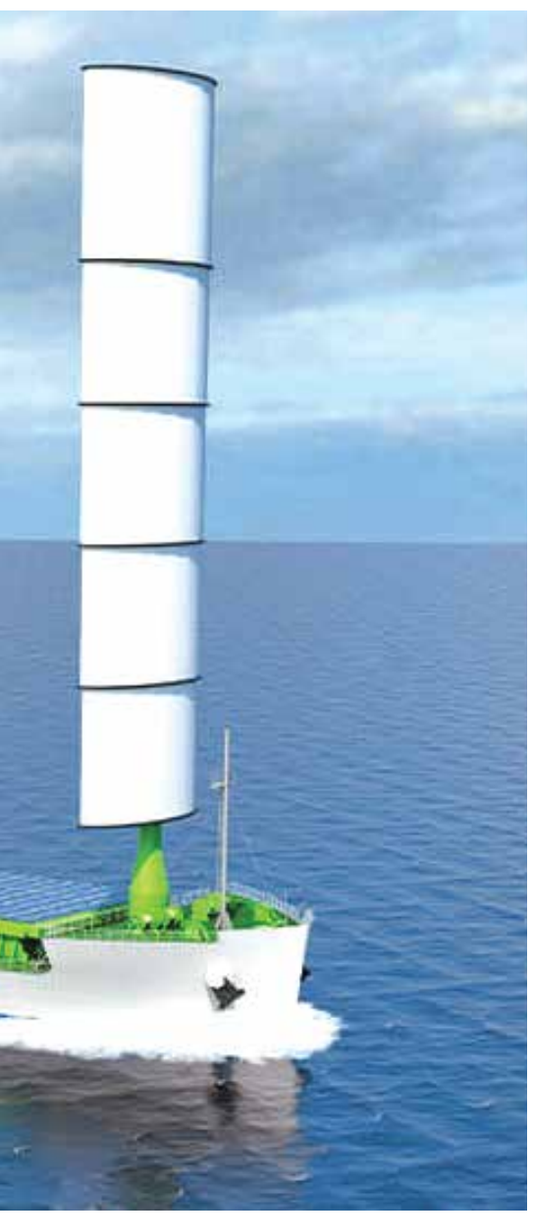
The global climate change issues are of vital importance for the shipping industry. Ship designers have applied new green energy technologies as well as efficiency strategies to set new records in eco-friendly shipping.

In response to IMO strategic plan and objective to reduce greenhouse gas emissions, Oshima Shipbuilding and DNV GL as the world's leading Classification Society have signed a long-term cooperation agreement to carry out study and research with the assistance of each other to progress in designing a new bulk carrier. The first design sample of this vessel, the "Oshima Ultramax 2030", reduces the energy efficiency design index "EEDI" up to 50%.

Since the beginning of 2008, the

The Ultramax 2030 design provides maximum efficiency and minimum GHG emission by using LNG as fuel, with an optimized hull shape and a hard sail in front to generate extra propulsion

IMO's strategic plan is to reduce the global greenhouse gas emissions from ships by at least 50% by 2050. Moreover, decreasing the intensity of carbon dioxide emission is another primary objective. Measuring CO2 emissions from ships by using per tonne-mile should be reduced by at least 40% by 2030, and the next goal will be reducing CO2 emissions up to 70% by 2050. After 2050, from the IMO's point of view, even greenhouse gas emissions could be descended to zero as early as possible in this century.



According to Mr. TrondHodne, DNV GL sales and marketing director "we need a road map for industries to achieve their proper position to meet the ambitious GHG emission targets set by International Maritime Organization (IMO) ".

Therefore, the cooperation between DNV GL and Oshima Shipbuilding will continue until 2030, aim to reduce GHG emissions to zero set by the International Maritime Organization (IMO). In order to reach this ambitious goal, other partners in the offshore industry will be invited to join the team.

The Ultramax 2030 design provides maximum efficiency and minimum GHG emission by using LNG as fuel, with an optimized hull shape and a hard sail in front to generate extra propulsion. Moreover, the design will use solar panel and batteries installation to supply floating power during the port and harbor operations.

Other designs are also available, such as using the shaft generator that creates the electrical output with batteries and choosing from two different main engine alternatives. The first choice is a high-pressure, two-stroke dual-fuel engine while the second one is a four-stroke dual-fuel engine.

According to information from major active ship-owners in shipping, seafarers and automatic identification system indicating the location of vessels and routes known as "AIS", ports, bunkering and cargoes, 40% of the world's major container ports provide access to LNG bunkering station, and more ports are planning to build or are constructing LNG filling station.

In the international arena, there is a growing need to provide LNG fueling stations delivering fuel for all fleets in long-distance trading activities, running on LNG as a fuel engine. Considering the available facilities at the LNG fueling station, Oshima Ultramax 2030 will be allowed for bunkering 2,000 m^3 LNG tank. This amount of fuel covers the round trip route from Singapore to South Africa, which is a major trading route.

Generally, an Ultramax bulk carrier spends over 50% of its time operating at sea and the remainder is spent either waiting or loading/unloading. On the other hand, the major ports that are capable of electrifying containers of the size of "Ultramax" are about 2%; therefore, undivided attention is given to reduce GHG emissions while waiting and in ports, Moreover, the plan is to reduce overall environmental footprint , not just while

sailing.

A number of solar cell panels have been designed and installed on the "Ultramax 2030" hatch covers, producing 88 kWh of power during sun hours available and the reminder 42 kWh are supplied by the batteries. With this amount of electricity generated, the expected power consumption of the vessels, which is 130 kWe, will be provided at ports and harbors.

The solar cell panel area is about 1,500 square meters (m2), covering all surfaces of ships' hatch doors. Considering 88 kW/d electricity generated daily, it can save up to 67,000 US dollars annually on fuel and maintenance costs of engine-generators. Expected payback period is about 10 years for the installation of solar panels and batteries.

During the night, the batteries can supply the power up to 3 hours before being fully discharged, and when the charging batteries is required, a diesel generator produces the electricity and charge the battery of the vessels with the maximum power efficiency and best possible electrical load. It takes about an hour to fully charge the batteries.

A hard sail glass fiber-reinforced plastic front-wheel drive assist with the generation of extra thrust propulsion power of the main engine. If needed, the sail will rotate automatically to obtain the best angle of attack to obtain the maximum push when wind conditions change. This firm sail system is jointly invented and owned by "Oshima" Ship building Company and "Mitsui O.S.K. Lines".

The sail is 60 meters high and has complied with the SOLAS regulation of Safety Of Life At Sea standards regarding Safe Sailing Visibility. Above mentioned sails are folded in a multi-layered during undesirable wind conditions, and while ship loading and unloading in ports. Oshima Company, in collaboration with the University of Tokyo and using a software tools to analyze the selected one-year climate data in the North Pacific, expects fuel savings of using the sail of about 10%. Regarding today's vessel operating costs; it is expected to save about 130,000 US dollars annually paid for purchasing less fuel.

In order to control the production and reduction of CO2 emissions of the shipping world fleet, compliance with the "EEDI" regulations introduced by International Maritime Organization IMO is mandatory globally by the ship owner. It is calculated by the tonnage unit of CO2 emission value and the carbon dioxide produced is defined as the mileage traveled for a particular speed and draft. It is obligatory for a new vessel to be built according to EEDI requirements being in designing phase. Therefore, ship owners of the new ships have to apply

to technical measures to construct ships with higher energy efficiency and less polluting in the future. This indicator is compulsory in accordance with "MARPOL Annex VI in 2011" which should be implemented since 2013.

Every 5 years, the EEDI's energy efficiency design index becomes stricter. Generally, the execution plan of a set of design and technical measures on vessels is entrusted to shipbuilders and when designers and shipbuilders comply with the EEDI standard (higher energy efficiency and less polluting), they avoid many other solutions that increase ship's fuel consumption.

The concept of the "EEDI" index extensively covers the energy consumption (fuel consumption) of the world's naval vessels. According to the International Maritime Organization (IMO), those vessels that are responsible for approximately 85% of CO2 emissions from the total amount of gas produced in the global fleet incorporated under this international rules and regulations.

Generally speaking, the ultimate objective of the Ultramax 2030 project is to create a new standard that increase the greatest amount of return on investment for ship owners. Thus, the use of today's technical methods is a key to minimize the greenhouse gases emission in this bulk carrier.

According to Stein Thorsager, Sales Director for Merchant & Gas Carriers in Wärtsilä Marine Solution, "our highly skilled maritime colleagues have joined with the team of various members to develop this project; presenting a perfect example of effective team cooperation".

Mr. Eiichi Hiraga, President at Oshima Shipbuilding stated that "the design of this vessel is based on the actual operating data and information of an "Ultramax" bulk carrier, utilizing LNG-fuelled Wärtsilä 31DF dual-fuel main engine, generating power out of the main shaft, and making use of the controllable pitch propeller (CPP) (the main engine can be selected from 2-stroke or four-stroke engine). Moreover, all the design goals for long-term efficiency and sustainability are met. This exploitation of higher efficiency and better adaptation to the marine environment has been provided by the initiative and collaboration of Wartsila and DNV GL". Oshima alone could think of this inventive design, which included choosing the best propulsion, energy storage and solar panel. In future, the owners of bulk carriers will be able to use this proven solution to comply with the requirements of maritime law enforcement while reduce vessel's operating cost".

Achieving such ambitious goal as a result of latest technical knowledge is a challenging issue both for Oshima, a leading designer in constructing of bulk carriers, and for DNV GL, the world's largest classification society, are pleased with results.

Finally, Mr. TrondHodne (DNV GL sales and marketing director) stated that "our companies, having major complementary operators, know how to apply highly skilled professionals in the field to make such an ambitious progress ".

Source:

www.dnvgl.com

Generally speaking, the ultimate objective of the Ultramax 2030 project is to create a new standard that increase the greatest amount of return on investment for ship owners. Thus, the use of today's technical methods is a key to minimize the greenhouse gases emission in this bulk carrier

AUTONOMY; A NEW SET OF OPPORTUNITIES AND CHALLENGES FOR MARITIME PLAYERS

Nor-Shipping is an international shipping exhibition and conference and one of the most important meeting places for the global maritime industry. In addition to the technology showcased by leaders in the market, Nor-Shipping is also the place to be to develop personal networks, build competence and share information. Marine Innovation magazine has conducted an interview with Mr.Per Martin Tanggaard, Director of Nor-Shipping.

Per Martin Tanggaard, Director of Nor-Shipping

How can autonomous ships make our future more sustainable? What is the role of smart ports?

The first phase of autonomous ship development will see a new breed of vessel focused on short sea shipping routes, relatively close to land. These will be used to take goods traditionally transported by trucks off on the roads and onto the sea. This will dramatically cut down on vehicle congestion and air pollution – especially so as the predictable, short distance routes will allow for pure battery power, and therefore zero emissions. The Yara Birkeland container vessel, launching here in Norway in 2020, will demonstrate the potential of this to the world and is a hugely exciting project. This was a major topic of discussion at Nor-Shipping 2019, where maritime and ocean industry players from around the world congregate to discuss the latest innovations, technology and new ways of realizing business potential in the ocean space. A lot of people are watching this project with intense interest.

Once the concept has been proved we'll see a wider acceptance of unmanned ships in both the industry and society as a whole, leading to greater adoption. This will lead to a range of benefits in terms of enhancing the sustainability of the maritime industry. Greater efficiency (enabled by data sharing and connectivity), automatically optimized routes (with just in time arrivals) and alternative fuels will reduce environmental impact, while the automation of processes and operations will remove the potential of human error, leading to less incidents and accidents.

Some will argue that jobs will be shed as a result, but the mood at Nor-Shipping this year seemed to suggest opportunity for new competency and roles too, with increased land-based employment and the need for digital skills. As an industry we have to evolve to survive and this adaptation of the workface is a part of that process.

In terms of smart ports, they will be a key enabler in the move towards autonomy (which, I have to add, will be gradual – instead we'll see increasing automation in the near

> **Fuel is obviously a key topic of discussion, especially against the backdrop of IMO 2020 and the longer-term plans for (eventually) making shipping a carbon neutral industr**

future, rather than widespread autonomy, as new technology is introduced to existing vessels to unlock greater insights and efficiency). Again, I refer back to the Yara Birkeland project. When the plans were presented in detail at Nor-Shipping it became clear that a whole new port infrastructure would be created to maximise value, safety and efficiency. This included self-driving straddle carriers, automatic mooring systems and automated loading and discharging. A new type of vessel demands a new breed of port.

As ship owners start to grapple with IMO 2020, do you think that LNG is the fuel of the near future by getting a significant way to complying with IMO 2020 as well as meeting 2030 CO2 targets?

I'll refer back to the discussions we have at Nor-Shipping, where industry chiefs, regulators, thought leaders and innovators take to the stage at our conferences and knowledge sharing events to help delegates plan for future challenges and opportunities. Fuel is obviously a key topic of discussion, especially against the backdrop of IMO 2020 and the longer-term plans for (eventually) making shipping a carbon neutral industry. In those discussions the prevailing wisdom seems to focus on a fuel mix rather than one specific fuel, such as LNG. The world is grappling with the need for an energy transition away from fossil fuels, and shipping with its need to preserve the fragile ocean environment, is at the vanguard of that (or it certainly will be in coming years). But there's no silver bullet as yet. So owners need to be open to adaptation, potentially investing in vessels that can run on dual (or multiple) energy and fuel sources. As with all walks of life, there's a

danger of 'putting all your eggs in one basket'.

However, I must stress, I'm not an expert… but at Nor-Shipping expertise is everywhere. My impression from that arena is the LNG is certainly a fuel of the near future, but saying it's the fuel may be going a little far.

Could you please brief us on the achievements of Nor-Shipping 2019 in the area of technologies such as Blockchain, big data, IoT and machine learning?

Nor-Shipping is known throughout the maritime and ocean business arenas as being the natural hub for innovation, forward thinking, and for the ability of participants to help set the course for the future of our industry. Digital technology is absolutely central to that. But we don't 'achieve' things in relation to the above areas – instead we provide a platform for others to showcase their achievements and share invaluable knowledge with our 50,000 plus delegates.

So, for example, at our Ocean Leadership Conference on Day 1 of Nor-Shipping 2019 we welcomed Admiral Michael S. Rogers, former Director National Security Agency & former Commander US Cyber command, to talk about the new risk environment created by increased connectivity, data sharing and automation, and how to tackle those challenges and seize opportunity. IMMARSAT led a session on 'trusting IoT', while the Maritime Digitalization Forum had leading thinkers from around the world delivering valuable insights on Blockchain, big data and much, much more. And this is just scratching the surface of an event week that offered a menu of over 220 conferences and events with more than 300 high level participants.

Nor-Shipping doesn't exist to put itself in the spotlight, but rather position our exhibitors, speakers, delegates and other key stakeholders center stage. This is 'Your Arena for Ocean Solutions', we are essentially here to help and add value in any way we can.

In the light of new regulations, do you expect a big transformation in the shipbuilding industry?

Regulations are always a driver for change, and the shipbuilding industry is not immune from this process. To predict whether they themselves will be the catalyst for a 'big transformation' is difficult though.

What we can say, from speaking to Nor-Shipping's attendees (who represent over 85 different nationalities) is that the segment is certainly dynamic and often unpredictable. With fluctuating demand, ongoing economic and geopolitical uncertainty, and developing environmental and regulatory requirements, that dynamism will no doubt continue.

Aside from the regulatory aspect, market forces and industry development will continue to prompt evolution. We'll see consolidation – as demonstrated by the recently approved merger of CSSC and CSIC – as key players fight for market share. And, ending where we began, the arrival of autonomy will bring a new set of opportunities and challenges for existing players. There will, we expect, be a real opening here for yards to position themselves as specialists in an area that will surely blossom in future years.

This is an industry that retains a sense of excitement and unpredictability. One thing you can be sure of though - whatever the future holds you'll be able to experience it at Nor-Shipping 2021 in Norway!

World boxship fleet update: Scrubbing out capacity

As lines prepare for IMO 2020 to come into force there has been an unexpected benefit for carriers. Scrubber retrofits are helping keep overcapacity in check

CONTAINER carriers have been keen to emphasise an improving balance between supply and demand in the boxship sector, and point to the removal of active tonnage for scrubber retrofits as evidence of the reduction of capacity.

This is true, to a point. The latest figures from Lloyd's List Intelligence put the capacity of idle vessels, those that have been recorded with no AIS movement for at least 25 days, at 806,083 teu at the end of November.

This represents 3.6% of total fleet capacity, and marks the highest amount of unemployed tonnage this year.

Figures from Alphaliner put the idle fleet even higher, with 225 containerships, comprising 1.3m teu, inactive as of November 25.

"Of these, 83 ships for 839,130 teu are inactive due to scrubber retrofits, accounting for 63% of the inactive capacity and 3.6% of the total cellular fleet," Alphaliner said.

Part of the reason behind the increased number of ships in lay-up for scrubber fitting is the length of time it is taking to have exhaust cleaning systems installed.

"Owners are reporting significant delays at shipyards which are currently straining to cope with the large number of retrofit projects prior to the implementation of the new IMO 2020 regulations due to limited access to trained labour and subcontractors," Alphaliner said.

Average yard stay for ships that have completed their retrofits currently stands at 58 days, excluding waiting time and positioning days.

According to Clarksons, vessel time out of service for scrubber retrofit is estimated to absorb 1.5% of boxship fleet capacity across full-year 2019 and 2% of capacity in 2020.

IMO 2020 is also likely to be behind other steps to absorb capacity, it added.

"Decreases in speeds, already down c.2% in the year to date, are ongoing as part of operators' efforts to manage fuel costs," Clarksons said.

But not everyone is convinced that scrubber installations will have a serious impact on fleet developments.

Speaking earlier this week, BIMCO chief shipping analyst Peter Sand said there had been only "anecdotal" reports of scrubber retrofitting having an impact of the fundamental fleet balance.

"We have seen an increasing number of ships being taken out of active service and put into yards for retrofitting," he said.

"But as we are operating with overcapacity, it hasn't brought around stronger freight rates as a balanced market would deliver when active capacity is removed from the market."

There are few positive signs of that overcapacity being removed soon, either. Clarksons said demand growth of 2.6% in 2020 would be outweighed by supply growth of 3.2%.

"Looking ahead to 2020, global container trade growth in teu-miles is projected to pick up slightly to 2.6% (3.1% in teu), with support from projected improvements on some non-mainlane trades," Clarksons noted. "However, risks to the outlook are mainly on the downside."

On the positive side, boxship orders had been relatively subdued in 2019, apart from a few notable exceptions, such as Evergreen's order for six 23,000 teu vessels, and five of a similar size ordered for Mediterranean Shipping Co.

For next year, Maritime Strategies International is forecasting just over 1m teu of deliveries, accounting for slippages and cancellations.

But it warned that a repeat of two "surprise" factors seen this year — a low volume of delayed deliveries and low volume of scrapping — could place its forecast of a deceleration in fleet growth at risk.

"We expect a higher volume of demolition activity in the coming quarters, although much will depend on how long scrubber-related disruptions will continue to buoy up the earnings of mid-size containerships, as without the larger units, a high aggregate level of scrapping is hard to achieve," MSI said.

Lloyd's List Intelligence figures put the global containership fleet at 22.4m teu at the end of November, up just 42,000 teu from a month earlier.

Deliveries were dominated by the 23,756 teu *MSC Mia* and 11,100 teu *MSC Kanako*, but there were no new orders reported during the month.

Scrapping, however, remained low-key, with Lloyd's List Intelligence recording just 6,500 teu being taken out of service permanently.

Kongsberg Digital and MacGregor collaborate to test digital solutions

Kongsberg Digital and MacGregor have entered into a collaboration agreement to test the interface of MacGregor's OnWatch Scout condition monitoring and predictive maintenance service within Kongsberg Digital's Vessel Insight data infrastructure solution.

The Vessel Insight solution enables high quality data from interfaced systems to be captured and transmitted in a cost effective and secure manner to the Kongsberg Digital Kognifai platform.

The initial in-service testing and data analysis will be conducted with application to MacGregor cargo handling cranes installed on pilot merchant customer vessels.

"It is essential for KONGSBERG to work with world-class partners, and we are therefore very pleased to be collaborating with MacGregor as we progress our common interest in accelerating the adoption of digital technology-enabled capabilities in support of the maritime industry becoming safer, more efficient and environmentally sustainable," said Vigleik Takle, senior vice president, maritime digital solutions, Kongsberg Digital.

"We are pleased to be extending our relationship with KONGSBERG and working closely with Kongsberg Digital to accelerate the testing of digital solutions, focused on further enhancing critical system safety, availability, efficiency and sustainability," says Dennis Mol, vice president, digital and business transformation, MacGregor.

ABB certified as Inmarsat Fleet Data provider

Inmarsat and ABB Marine & Ports have signed a Master Supply Agreement, certifying ABB as an application provider to work with Fleet Data, the IoT platform developed by Inmarsat and Danelec Marine.

The purpose of the agreement is to tackle the difficulty shipowners have in getting data off ships in real-time. A recent 2018 Inmarsat survey of 125 owners found 51 per cent identifying this as their main obstacle to IoT adoption.

As a certified application provider, ABB will work with Fleet Data, which collects information from onboard sensors, pre-processes it, and uploads it to a secure cloud-based database.

The new Certified Application Provider (CAP) agreement means analytics, monitoring and decision-support software, developed by ABB Marine & Ports to benchmark fleet performance as well as enhance ship efficiency and safety, can seamlessly integrate with a database via the Fleet Data Application Programming Interface (API).

"As respective leaders in the field of mobile satellite communications and marine power, control and automation technologies, Inmarsat and ABB combine connectivity and enabling applications at a scale that can be truly transformative," said Stefano Poli, vice president business development, Inmarsat Maritime.

"This deal provides further evidence of the power of Fleet Data to rise to the challenge. As a digital enabler, Fleet Data can support a myriad of applications so it is no coincidence that Inmarsat has signed agreements with digital technology majors as well as start-ups intending to shake up the industry," he said. "Both groups recognise that developing a digital culture is about downloading and updating, not expensive ship visits and installation time."

"Collaborative operations that put our cumulative engineering knowledge, leading-edge products and remote support at the disposal of those at sea and ashore are core to the ABB Marine & Ports Service offering across a wide range of vessel types," said Antto Shemeikka, vice president digital services ABB Marine & Ports. "We see the potential for faster digitalisation enabled by continuously evolving connectivity."

KR and Hyundai LNG Shipping sign MoU on cybersecurity research

The Korean Register and Hyundai LNG Shipping have signed a memorandum of understanding (MoU) agreeing to conduct joint research on the application, verification and development of Guidance for maritime cybersecurity systems.

The MoU brings together KR's maritime cybersecurity certification capability and HLS's expertise in cybersecurity technology. Under the agreement, the two companies will jointly verify cybersecurity solutions applicable to new ships and will develop risk analysis and design safety evaluations for cybersecurity systems.

The IMO's Resolution of MSC.428(98) adopted at the 98th meeting of the Maritime Safety Committee in June 2017 will increase demand for cybersecurity risk management from 2021. From this date, Administrations will be obliged to ensure that cyber risks are appropriately addressed in safety management systems no later than the first annual verification of the company's Document of Compliance after 1 January 2021.

"The MOU and resulting joint research conducted with HLS will strengthen KR's capabilities in the certification of new ships, ensuring our organisation's position as technological industry leader in maritime cyber security sector," said Ha Tae-bum, executive vice president of KR's R&D Division.

"HLS is pleased to sign this important MoU with KR, as a commitment to develop our proactive cyber security expertise to further support shipowners and their vessels when the new regulations come into force," said Choi Jang-pal, head of business operation division, HLS.

Spanish shipbuilding company Navantia has entered into a Memorandum of Understanding (MoU) with InfraStrata, a UK quoted company focused on strategic infrastructure projects and physical asset life-cycle management.

Digital Ship returned to Athens last week, November 13-14, 2019, for its 17th Annual Maritime Conference & Exhibition.

CyberOwl, a UK-based start-up specialising in protecting industrial systems from cyber-attacks, has been selected as a founding member of the Eastern Pacific Shipping (EPS) accelerator powered by Techstars, a global innovation programme run directly by a shipping fleet operator.

To facilitate shipowner demand for an immediate cybersecurity solution for critical systems, Naval Dome has introduced a new software-based cyber protection that can be easily installed on all ship, port, or offshore OT systems, including navigational equipment, machinery control systems and cargo handling equipment.

ABS and DSME sign digitalisation and decarbonisation agreement

ABS and Daewoo Shipbuilding & Marine Engineering (DSME) have signed a joint development project (JDP) agreement to explore decarbonisation and digitalisation strategies for Very Large Crude Carriers (VLCC) and Ultra Large Container Ships (ULCS).

The JDP aims for DSME to develop ABS approved VLCC and ULCS vessel designs, which offer potential solutions to IMO 2030 decarbonisation goals. The JDP also covers Onshore Remote Monitoring, SMART and Autonomy technology as well as development and review of cybersecurity aspects associated with the DSME Smart Ship platform.

"ABS is assisting leading shipping lines with evaluation of their decarbonisation and digital strategies all over the world," said Patrick Ryan, ABS senior vice president, global engineering and technology. "This JDP will help us harness the potential of digitalisation and drive forward decarbonisation goals for the industry."

"There is increasing demand in the marine industry for vessels which have a low carbon and greenhouse gas emission footprint. Leveraging digital technologies provides a means to assist in addressing these decarbonisation challenges. At the same time, the increased connectivity onboard vessels can introduce cyber related threats which need to be appropriately addressed. DSME and ABS will work together to evaluate solutions to address the decarbonisation challenges, including exploring the potential of digital technology," said Mr. Odin Kwon, DSME CTO, engineering & technology unit.

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Shanghai International Shipping Agency Ltd.

BRIEF INTRODUCTION OF ISACO

Shanghai International Shipping Agency Group(ISACO) exists as a company initially invested and established by the Affairs Bureau of the Ministry Communications (MOC). Through the collection of social capital, the company has become a Leading shipping agency window in the region and today, the ISACO Group has a total asset of 50 Million RMB.

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