New opportunities for seafarers owing to reduction emission and arising the number of Dual fuel vessels

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Abstract. Nowadays one of the main goal of International Maritime Organization (IMO) is to reduce pollution by vessels over the world. Due to this they implemented in MARPOL Annex VI the requirements for any gas vessel’s emissions which are setting the limits and timelines of compliance. To overcome this problem IMO adopted on 15th July 2011 the commence measures for improving vessel’s energy efficiency plan and reducing emissions of greenhouse gases (GHG). The main strategy of GHG envisages the reduction of international shipping in carbon intensity (reducing CO2 emissions from transport activities on average for international shipping from 40% to 70% by 2050). According to this, growing the problem concerning new opportunities for seafarers. That was managed on example by crewing company Nordic Hamburg at implementation the new trainings.

1. Introduction
Nowadays, all shipping companies over the world are committed to protect environmental pollution. In turn, the International Maritime Organization has drawn up several documents accompanying the promotion of environmentally friendly transport. For this reason, each company is developing new technologies to reduce emissions of pollutants into the environment and plans for training courses for seafarers.

The package of measures of new Chapter 4 of MARPOL Annex VI entitled “Regulation on energy efficiency for ships” for operational reduction measures and new vessels is composed of two main measures [1]:

1. The Energy Efficiency Design Index (EEDI).
   It requires to comply new vessels with minimum mandatory energy performance levels, which are increasing through different phases over time.
2. The Ship Energy Efficiency Plan (SEEMP).
   It establishes a mechanism for shipowners which provides improving the energy efficiency of new existing vessels using operational measures such as trim, weather routing, draught optimization, speed optimization, etc.

Furthermore, IMO persists committed to reducing GHG emissions from international shipping and, the most urgency, aims to phase them out as soon as possible in this century [2].

The GHG strategy identifies some need for further optimization of supply chain planning, as well as the development of energy from renewable sources, including alternative low-carbon and zero fuels and innovative technologies (Fig. 1) [3].
Reducing emissions to air and introducing new propulsion technologies are key challenges for the worldwide transport sector, including shipping. Therefore, in the nearest future, the task is to select a wider range of alternative fuels in order to improve energy efficiency. International initiatives towards reducing CO\(_2\) and other emissions are driving the research into alternatives to conventional petroleum-based ship fuels.

A wide range of alternative fuels are being discussed, it includes alternative ship fuels as biofuel and hydrogen, LPG, LNG, methanol – as well as emerging technologies such as batteries, wind-assisted propulsion, and fuel cell systems. Using scrubbers is also an alternative technology to reduce carbon emissions. The development and analyze of alternative energy/fuels sources and technologies are essential importance in reduction of GHG Emissions and for creating a sustainable world.

2. Requirements for Dual-Fuel container vessels

One of the alternatives is the natural or Liquified Natural Gas (LNG). Its main component is methane (CH\(_4\)), the hydrocarbon fuel with the lowest carbon content and therefore with the highest potential to reduce CO\(_2\) emissions (maximum reduction: roughly 26 per cent compared to HFO). The production process of LNG ensures that it is practically sulphur-free. Therefore, using LNG as fuel does not produce any SOX emissions.

LNG technology was chosen by several Shipping and Liner Companies, one of the biggest is CMA CGM (France), which build containerships with Dual Fuel technology up to the size of 23K TEUs.
New opportunities for vessels which are using LNG technology:
1. Optimization of ME operation as LNG if more efficient as HFO.
2. Optimize the power management system to operate the auxiliary engines on an optimal load.
3. Opportunity to use useful LNG storage.
4. Using of Boil-Off Gas for Dual fuel boiler, utilization as fuel in Engine equipment.
5. New Bunkering procedure for the container vessels.
6. New Safety procedures and Risk Assessment.
7. SIMOPS procedures coordinated between ship-shore side.

Qualified Crew is essential importance for the new technologies on ships. Due to this shipping requires a good education of the young generation and training of the existing crew to fulfil market requirements due to the change of technology in the next decade.

Focusing on the demand for trained maritime manpower within the dynamic economies as a result of the rapid development of shipping and the broader shipping industry.

Looking back historically the Industrial Revolution brought with it requirements for new skills that led, inevitably to the creation of new grades of seafarer and hence new divisions of labour. Mechanical propulsion changed not only the means by which a ship progressed from one place to another, it also changed the role of ‘seamen’ whose skills alone had previously been sufficient to undertake this process.

As engines and auxiliary machinery became more complicated and powerful, so the need for more specialised or advanced engineering skills increased. Engineers gradually became more involved in matters directly related to the purpose of the voyage [3-5].

3. Results and Discussion

3.1. Requirements for new crewmembers

Vessel propulsion and power generation will be a considerable area of technological development. Firstful it includes alternative fuels, future engines, renewable sources [6, 7]. To improve the ecological state of the propulsion system, it is possible to reduce the cost of fuel with a hybrid power plant while significantly reducing greenhouse gas emissions [8].

Demand for qualified crew:
1. Smart Shipping.

Trend of shipping is that in nearest future 10% of all commercial fleet will consist of smart ships. That can be data-driven services such as vessel weather routeing and performance monitoring. The modern smart ship will integrate a variety of connected technologies to improve ship management, operational efficiency, regulatory compliance, environmental responsibilities, decision making, and also improve maintenance and safety of vessel and crew through communication networks.

There are enough number of benefits of autonomous vessels, such as more efficient use of space in ship design, lower costs, and reduction of risk of human error onboard, which has been the main cause of accidents at sea.

2. Big Data and Analytics.

IT infrastructure will be streamlined to store, retrieve, and process data in real time. Due to the support of communication technologies, archived data can be stored either onboard a ship or onshore. Moreover, cognitive systems will act as data dragomans for humankind. These systems will integrate natural language processing into machine learning to offer an intuitive interface between a person and a machine.

Nowadays the most common type of information exchange between vessels and shore’s managements is done by electronic files. Investigation of this update shows that is much convenience for all parts of community. IT technologies provides new stage of communication for seafarers. Due to these trainings at these ways are much popular. Also, this type of system will simplify the studying of machine processing.
3. Advanced Materials.
A new generation of machinery will appear with enhanced productiveness. Inherent smart features can be developed for corresponding applications. These may include self-repairing and self-cleaning materials, which would have a innumerable of benefits when it comes to maintenance and safety.

By the model designed comprehensive crew qualification evaluation index system, which provides reference for crew performance assessment and further amended crew human resources management and career planning.

4. Robotics.
In the 2030 should be developed three new types of robots. These robotics will steppingstone: imitation, cognition, sense, versatility and adaptability. The development of these types of robots is very closely connected to the evolution of other technologies, such as remote controls and sensors.

5. Sensors.
The enjoyment of sensors will present a powerful opportunity for improvements in the safety and efficiency of vessels like as associated equipment’s. The data which is generated by sensors will have great potential within the commercial shipping sector. To reach the goal of improving the commercial shipping sector requires analysis strategies and real-time monitoring.

The seizure of top-quality data from vessel by means of reliable sensors and robust will open up new ways of enhancing vessels’ life cycles. This development will provide data which will need to be properly transferred, stored, and analysed.

6. Communications.
Nowadays, vessels generate, transmit and collect an ever-increasing volume of data. To accomplish efficient data transfer, wireless communications have been widely digested for many years. For expels, these were developing of satellites, marine very high frequency (VHF) installations and WiFi which allows you to transfer at a higher baud rate [9].

Under the Regulation of International Convention on Standards of Training, Certification and Watchkeeping for Seafarers all crewmembers must complete vessel specific familiarization and basic training before assuming responsibilities and duties for ships with dual fuel engine find the list of other certificates:
1. Basic Training for crew responsibility of designated safety duties.
2. For Engineer Officers, Masters, and all persons with Immediate Responsibility require certificate of Advanced training for use and care of fuel.
3. Current holders of Tankerman Assistant LG and Tankerman PIC LG meet the requirements of qualification (with 3 months service in last 5 years plus company and ship specific training).

3.2. Special trainings by Nordic Hamburg Shipmanagement
Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), and STCW Code contain new mandatory minimum requirements for the qualifications and training of masters, officers, ratings and other personnel on vessels subject to the IGF Code [9].

To solve this problem was developed special course “Black Sea Training” by Nordic Hamburg Crewing Management (Fig. 2). Upon completion of these courses, it is possible to receive:
1. Basic certificate.
2. Advanced certificate.
3. Ship specific familiarization certificate.

Basic certificates issue for crewmembers with distinguished safety duties, that are associated with the emergency response, care or use of the fuel. Advance certificate issues with the same requirements as Basic certificate but intend Mainly for Engineer Officers and Masters. To achieve this certificate, it needs at least 1 month of onboard practice an LNG fuel vessel and affiliation with minimum 3 bunkering operations. Two of these bunkering operations can be completed through simulations. In case of obtainment of vessel specific familiarization certificate, the minimum requirements for
Seafarers on gas fueled ships is familiarization with the vessel according to the SOLAS requirements, which is like the standard process.

![Diagram showing a flowchart of technical training courses including Deck and Navigation, Engine, Passage planning, Dry docking, and Cadet training.](image)

**Figure 2.** Technical training course developed by Black Sea Training.

The amplitude is that crewmembers need to be competent to carry out onboard a vessel firefighting operation that uses these low flash point fuels, and for that explanation the seafarers need to have sufficient proficiency and knowledge for items like:

1. Actions to be taken to prevention fire on LNG fueled vessels.
2. Special perils associated with handling of LNG fuel systems.
3. Method to control, detect and extinguish fires involving low flash point fuels.
4. Operation of firefighting system.

Training major concept is changing ratio – do not a collection of competent individuals addressing crew member attitudes, do not focus on skills of crews as inviolate teams and behaviour providing three sets of objectives [10, 11]:

1) specific behavioural objectives and training objectives;
2) providing e-learning for transfer of facts;
3) utilizing case studies, table top exercises and human interaction to change respects.

**4. Conclusions**

The main strategy of GHG envisages the reduction of international shipping in carbon intensity (reducing CO2 emissions from transport activities on average for international shipping from 40% to 70% by 2050). According to this, growing the problem concerning new opportunities for seafarers.
That was managed on example by crewing company Nordic Hamburg at implementation the new trainings. To support the green direction by Nordic Hamburg Crewing was integrated special training courses to preparing seafarers which provide sustainable shipping industry, especially: a) oceans; b) communities; c) people; d) transparency; f) finance; g) energy.

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