【欧州】【海事】

Maritime - Environmental issues: Development of zero-emission vessels and the UK's plan for introducing zero-emission technologies for vessels

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【概要：Summary】

In maritime transport, the two main initiatives to reducing emissions are the International Maritime Organisation (IMO)'s new regulation of introducing a new global sulphur limit and the reduction of GHG emissions. On 1 January 2020, the new IMO regulation for limiting the sulphur content of bunker fuel to 0.5% m/m (mass by mass) will be introduced for all areas outside emission control areas (ECAs). Regarding GHG emissions, the maritime transport is not included in the Paris Agreement on reducing the global warming to 1.5 C° above 1990 levels. However, on 13 April 2018, the IMO's Marine Environment Protection Committee (MEPC) 72 adopted the initial strategy on GHG emission reduction for international shipping and related guiding principles. The strategy is intended to be the first step in a three-step approach towards achieving a reduction of GHG emissions in maritime transport. However, the IMO's envisaged target of a 50% reduction of CO2 emissions by 2050 based on 2008 levels will require additional emission reduction measures including alternative fuels and propulsion systems and the development of low- and zero- emission vessels. The Lloyd's Register (LR) and the University Maritime Advisory Services (UMAS) published a study entitled "Zero-Emission Vessels 2030. How do we get there?", which aims at demonstrating the viability of zero-emission vessels (ZEVs). The concept of ZEVs aims at ending the utilisation of fossil fuels. ZEVs can provide the logistics of current fleets, but without operational emissions. The study also identifies the measures needed to make them a competitive solution towards decarbonisation. One conclusion is that ZEVs would need to be entering the fleet by 2030 and form a significant proportion of new-builds thereafter. The more recent LR-UMAS study "Zero-Emission Vessels Transition Pathways" aims at explaining the necessary requirements for enabling the transition at ship level and supply infrastructure level in order to deliver ZEVs before 2050. Based on the LR-UMAS research, studies and recommendations regarding ZEVs and the probable timeline for introducing them, the UK's Department for Transport has published a new strategy document entitled "Clean Maritime Plan". The Clean Maritime Plan shows a pathway towards zero-emission shipping for the UK in order to tackle maritime transport's GHG emissions and other air pollution.

【記事：Article】

1. Initial efforts by the IMO and the EU to reduce emissions from maritime transport

Fossil fuels still provide a high-density and low-cost energy source in maritime transport. However, considering the necessity to reducing the climate impact of maritime transport, fossil fuels have to be replaced by other energy sources for propulsion, which have less or no climate impact. In maritime transport, there are two main initiatives to reduce

emissions, including the reduction of sulphur contents of marine fuels and the reduction of GHG emissions. Accordingly, also zero-emission and sustainable energy sources have to be considered in maritime transport.

There are only few months left until the IMO's new global sulphur limit of 0.5% m/m (mass by mass) will be introduced for all areas outside emission control areas (ECAs) on 1 January 2020. Regarding GHG emissions, on 13 April 2018, the IMO's MEPC 72 adopted the initial strategy on GHG emission reduction for international shipping and guiding principles. The new mandatory data collection system for reporting the ships' fuel oil consumption and the adoption of the strategy to reduce GHG emissions from shipping are the first measures in a three-step approach. The initial strategy identifies levels of ambition for the international shipping sector for reducing GHG emissions from ships and aims at reducing the total shipping sector's GHG emissions by "at least" 50% by 2050, from 2008 levels. The initial strategy includes a reduction of CO2 emissions per transport work, as an average across international shipping, by at least 40% by 2030, and towards 70% by 2050, compared to 2008. However, the IMO's initial strategy does not give a schedule for the set-up of legal restrictions on CO2 output. It is rather a framework for IMO member states to set levels of ambition to reduce GHG emissions.

Since the progress in setting up a regulation for reducing GHG emissions from shipping at international level was initially very slow, the EU introduced the Regulation (EU) 2015/757, on the monitoring, reporting and verification of CO2 emissions from maritime transport as of 2018. Large ships above 5000 gross tonnage using EU ports are required to report their verified annual emissions and other relevant information. Furthermore, the EU also called on the IMO to introduce a system for global GHG emission reduction by 2021, comparable to its emission trading scheme (EU-ETS), otherwise the EU would prepare legal steps for including the shipping sector in its EU-ETS, starting from 2023. Meanwhile, on 4 February 2019, the European Commission adopted a proposal for revising the EU's monitoring, reporting and verification system for CO2 emissions from maritime transport (Regulation (EU) 2015/757), (COM (2019) 38/F1). The proposal aims at taking appropriate account of the global data collection system for fuel oil consumption of ships, and to facilitate the harmonious implementation of the EU and IMO systems.

2. The propulsion and fuelling options towards low- and zero emission ships

The IMO's envisaged target of a 50% reduction of CO2 emissions by 2050 based on 2008 levels will require additional emission reduction measures including alternative fuels and propulsion systems.

LNG is considered being one of the alternatives to crude oil in maritime transport. However, it is still far from being a sustainable solution as long as the additional methane emissions that occur during LNG processing and bunkering are not eliminated. Another alternative fuel for maritime propulsion is the utilisation of fuel cells and hydrogen as energy source. They have a potential as a future ship propulsion with good experience gained in auxiliary and low-power propulsion machinery. Therefore, fuel cells could play a greater role as propulsion systems, especially if the hydrogen is produced using renewable energy sources.

Furthermore, there exist the category of biofuels, the new biofuel oil (BFO). BFO could offer ship-owners and operators an alternative to comply with the 2020 0.5% sulphur cap requirements, as well as with the IMO's 2050 GHG reduction rules. Shipping companies like the Danish shipping company Norden A/S (D/S Norden or NORDEN) are already testing some new biofuel oil produced by GoodFuels. The GoodFuels drop-in biofuel oil (BFO) is a new marine biofuel, which almost entirely reduces all carbon and sulphur emissions, according to its developer GoodFuels Marine. GoodFuels Marine has focused on the use of bio-marine gas oil (MGO) equivalent biofuel, and developed this BFO solution in order to meet the IMO's 50% GHG emissions reduction target. The importance of the new fuel lies in the fact that it is serving both,

the sulphur emissions reduction and the GHG emissions reduction.

Furthermore, ship builders are also considering new ways to build low emission ships. The Wallenius car carrier vessel utilizes three different propelling systems for its day-to-day operations. The so-called Orcelle green ship concept uses electrical systems, wind and wave power and fuel panels incorporating hydrogen in order to achieve the zero emission ship status.

The NYK's Super Eco Ship 2030 Concept and the built cargo ship's designing is completely streamlined with utilization of solar and LNG (Liquefied Natural Gas) cells to aid its maneuvering on water. The absence of conventional fuelling systems and electronic-based freight loading and unloading processes will make the Super Eco Ship 2030 a zero emission ship. Furthermore, there exists the concept of the "next-gen Container Feeder The GL shipping company's Vessel ZERO would function extensively on LH_2 (Liquid Hydrogen) and hydrogen-powered fuel panels, making it a zero-emission ship model. GL is also aiming at a constructional aspect of reduced operational speed so as to enhance the viability of the vessel in the Northern European water zone. Another concept is the shipping company Scandlines' Futureship Zero-Emission Ferry Concept, using a variety of zero emission technologies including photovoltaic systems, fuel cells and Flettner rotors. The double-ended ferry has been designed to have space for 1,500 passengers and 2,200 lane meters for vehicles. With this concept, Scandlines aims at a totally emission-free ship for future ferry operations. Moreover, there is a fleet of B9 Cargo Ships vessels constructed and operated by the B9 shipping company. This vessel type does not utilize any kind of conventional fuelling systems but instead is operated through methane fuel (biogas) and energy derived from wind. Finally, Mitsubishi's Emerald Ace, is not a total zero-emission ship type when sailing at sea, but the car carrier ship does not emit any noxious gases while berthed. Furthermore, solar fuel panels along with lithium-ionised batteries helps to power the ship at all times.

3. The concept of zero emission vessels: The LR and UMAS study on pathways to zero emission ships

Due to the fact that the transport sector was explicitly excluded from the UNFCCC's COP21 Paris Agreement of future CO2 emission reduction, the pressure on the IMO increases to take meaningful measures to mitigate the CO2 emissions from international maritime transport. The shipping industry has to find ways to apply alternative fuels and propulsion systems and to find zero-emission and sustainable energy sources.

In December 2017, the Lloyd's Register (LR) and the University Maritime Advisory Services (UMAS) published a study entitled "Zero-Emission Vessels 2030. How do we get there?", which aims to demonstrate the viability of zero-emission vessels (ZEVs). It also identifies the drivers that need to be in place to make them a competitive solution for decarbonisation. The report also assessed seven technology options for ZEVs, applied to five different case study ship types across three different regulatory and economic scenarios. The study concluded that ZEVs will need to be entering the fleet in 2030 and they will have to form a significant proportion of new built ships from then onward. The logistical challenges and the wide range of operational requirements in the shipping industry mandates the need to consider an equally wide range of potential technologies, particularly given the present lack of a clear dominant solution suitable for all types of ship.

Meanwhile, the more recent LR and UMAS study entitled "Zero-Emission Vessels Transition Pathways" examined three key energy pathways to help identify the actions required for the shipping industry in the transition to a zero-carbon future by 2050.

The new "Zero-Emission Vessels Transition Pathways" study aims to show key milestones, barriers and enablers, and considers cost implications, operating profile and how policy measures such as carbon pricing could influence the outcomes. The study aims to show what is needed to enable the transition, both at the

ship and supply infrastructure level towards achieving the IMO's GHG reduction target of 2050. The study indicates that all pathways explored will achieve the IMO ambition of at least 50% reduction in GHG emissions by 2050. It confirms that zero carbon is possible but early action particularly between 2020 and 2030 is needed. It can be expected that in the 2030s, the market will see a scaling up of zero-carbon solutions and a consolidation of what the dominant technologies for use on board will be. In the 2020s, a growing share of biofuels produced from renewable electricity, referred to as electro-fuels, will enter the market. This is expected to result in a major shift to electro-fuels in the 2040s and 2050s. All pathways explored in the study will achieve the IMO's ambition of at least 50% reduction in GHG emissions by 2050 and go beyond to show that zero-carbon is possible. According to the LR-UMAS study, from a practical perspective, if zero-emission vessels (ZEV) need to enter service by 2030, anyone planning to finance, design or build a ship in the 2020s will need to consider how it can switch to non-fossil, zero emission technologies such as wind, hydrogen fuel cells and batteries later in the vessel's operational life. In this context, the decade 2020 - 2030 will be the most significant und underlines the need for early action. There is still uncertainty when choosing one fuel, one technology and one route and therefore this decade will need to see full-scale pilots and prototypes. Batteries in short-sea markets, or hybrid solutions as well as on-shore power supply will play an important role in reducing the dependency on fossil fuels. Easy to store zero or low-carbon fuels (for example sustainable biofuel and methanol) may also be a solution as existing infrastructure and machinery can be used to ease the transition. In the 2030s, the evolution of ship fuel mix will be closely linked to the evolution of the wider energy system. Ships could be designed to store less energy on board and changes to their operating profile to bunker more frequently. In order to be in line with the Paris Agreement targets, ZEVs need to be entering the fleet around 2030 and a significant portion of new-builds will have to be zero emission to compensate for the non-zero emissions of the existing fleet. Most importantly, the study reveals the necessity to think beyond marginal gains in energy efficiency and alternative fossil fuels in order to find the maritime sector's least-cost decarbonisation pathways. Until the 2050s, more than one switch of pathways might occur. By 2050 and beyond a consolidation of the market with an end fuel mix dominated by one family of new fuels can be expected.

4. The UK government's Clean Maritime Plan

Taking the LR-UMAS study, research and recommendations as a basis regarding the zero-emission vessels technology and the timeline for introducing them, on 11 July 2019, the UK's Department for Transport published a new strategy document entitled "Clean Maritime Plan". The Clean Maritime Plan forms the Environment Route Map of the UK's Maritime 2050 strategy, which includes the recommendations for developing the UK's maritime sector across a range of topics. By launching the Clean Maritime Plan, the UK government intends to take a proactive role in the transition towards zero emission shipping in UK waters. It sets out in more detail how the government sees the UK's transition to a future of zero emission shipping. The Clean Maritime Plan includes policies to tackle GHG emissions and air pollutants from shipping, while ensuring the UK's economic benefits of the global transition to zero emission shipping. The Clean Maritime Plan supports a high level of ambition on emissions reduction and is expected to provide enough direction to give investment certainty.

The Clean Maritime Plan acknowledges that energy efficiency improvements alone will not be sufficient and that the use of alternative fuels such as hydrogen, ammonia or methanol among others will be required. Referring to the 2017 study of UMAS, the UK Department for Transport's plan also emphasises that "LNG is not estimated to be a substantial part of the fuel mix in the future" and also electrification is expected to play a smaller role compared to alternative fuels. On

the subject of why some of these technologies and alternative fuels are not being taken up and how this situation could be overcome, the Clean Maritime Plan cites the work done by UMAS on barriers and innovative financing solutions and alignment methodologies.

One of the UK's targets will be that all new ships ordered from 2025 onward will need to include also a zero emission technology if they are going to be actively used in British waters. By 2035 it is expected that the UK has built "a number" of clean maritime clusters at ports. However, the targets are only "aspirational goals" and are not mandatory. Concerning regulations, the UK government will establish the Maritime Emissions Regulation Advisory Service (MERAS) by 2020, which will provide dedicated support to innovators using zero emission propulsion technologies, supported by the Maritime and Coastguard Agency.

According to the UK's Parliamentary Under-Secretary of State at the Department for Transport Nusrat Ghani, the Clean Maritime Plan is expected to help making the UK a global hub for green technologies in the maritime sector.

Considering the next necessary steps, the Clean Maritime Plan points out that a Green Finance/Financing Green initiative for shipping will be announced at the London International Shipping week, in September 2019. The UK's Department for Transport will also issue a public consultation on the further use of Emissions Control Areas to improve UK air quality, issue a call for evidence directed at UK domestic shipping seeking information on emissions from the sector and possible approaches to mitigate them. It will also issue guidance to support major English ports in producing Air Quality Plans. In 2020, the UK government will launch a call for evidence on non-tax incentives to support the transition to zero emission shipping. The government will consult on a possible maritime amendment to the Renewable Transport Fuel Obligation, undertake a study to identify and support potential UK zero emission shipping clusters and it will act appropriately on the results of the Call for Evidence on Domestic Shipping and the ECA consultation, among others. Considering the Clean Maritime Plan's targets towards zero emissions shipping, the collaboration between the government and industry will be important. It will require commitment until the year 2050 and beyond, and the actions taken now are vital in helping to reach the goal of establishing zero emission shipping.

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