OUR INVESTMENTS IN SUSTAINABLE SHIPPING

Continued investment and steadfast commitment are needed to forge a new sustainable path forward for the shipping industry. Since 2017, we have been investing in dual-fuel ships that will allow us to meet the IMO's 2030 target of reducing GHG emissions intensity by 40% (against 2008 baseline) as well as our own long-term commitment of net-zero emissions by 2050. Between 2022 and 2023, we have made strides towards meeting these goals.

DELIVERED: AMONG TWO OF THE WORLD'S FIRST LNG DUAL-FUEL VLCCS

In 2022, we delivered two LNG dual-fuel VLCCs that are among the world's first such vessels. A game changer with a carbon footprint reduction that supports our sustainability goals, Eagle Vallery and the award-winning Eagle Valence were delivered to TotalEnergies for long-term charter. Another three LNG dual-fuel VLCCs will be delivered to Shell for long-term charter in 2023.

IMPLEMENTING SOLUTIONS TO REDUCE METHANE SLIP ON OUR ASSETS AND IMPROVE WELL-TO-WAKE EMISSIONS

In 2021, AET, along with Shell Ventures, Trafigura and Saudi Aramco Energy Ventures, invested in Daphne Technology. Based in Lausanne, Switzerland, Daphne Technology is an award-winning Climate Deep Tech company involved in developing innovative technology that removes GHG and toxic emissions for maritime and onshore industries. As part of its decarbonisation journey, AET intends to implement one of Daphne Technology's products, SlipPure™, as a potential solution to address methane (CH_4) emission from ship engines' exhaust gas. SlipPure™ is an innovative exhaust gas cleaning system that is deployed in natural gas-fired internal combustion engines in maritime, oil and gas and land-based industries. This solution has been granted Approval in Principle by both DNV and Lloyd's Register. We will be trialling SlipPure™ on our LNG dual-fuel vessels in the next two years and we will continue to invest in technologies to reduce CH_4 slip and well-to-wake emissions, as part of our investment in sustainable solutions that support maritime decarbonisation.

IN THE WORKS: SPEARHEADING THE INDUSTRY'S DECARBONISATION JOURNEY WITH THE DEVELOPMENT OF ZERO-EMISSION VESSELS

In April 2022, AET signed an MOU with Lloyd's Register and Samsung Heavy Industries (SHI), as part of the Castor Initiative, to develop and construct what is likely to be the world's first zero-emission ammonia-powered VLCCs. To be owned and operated by AET, the two ground-breaking vessels are targeted to be delivered in late 2025 and early 2026. With the project, Lloyd's Register, SHI and MISC, as founding members of the Castor Initiative, are taking the lead to demonstrate both the commercial feasibility of ammonia as a clean fuel for the shipping industry and the need for collaboration within and across industries.

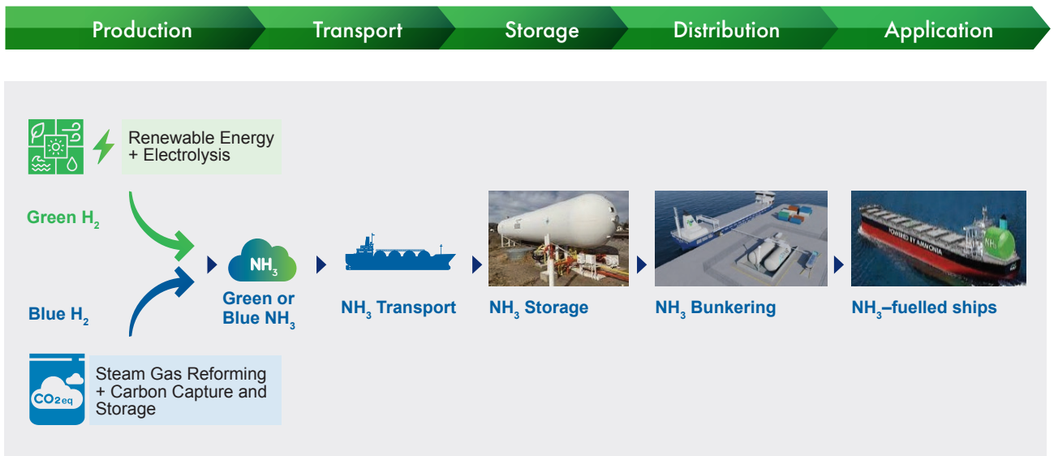
Following this milestone collaboration, AET further underscored its commitment to investing in ammonia-powered vessels by signing two more MOUs.

In September 2022, AET and Thai national energy company PTT inked an MOU to develop and build two zero-emission Aframaxes powered by green ammonia. The dual-fuel tankers are scheduled to be delivered to PTT for long-term charter in late 2025 and early 2026. The MOU reflects the shared ambition of both parties to accelerate the pace of decarbonisation in the sector. Both PTT and AET view ammonia-powered vessels as one of the viable pathways to achieving the industry's decarbonisation goal.

The collaboration goes beyond the delivery of the Aframaxes. Under the MOU, AET and PTT will work together on the design, safety and operational aspects of the vessels and the reskilling of mariners to arm them with the specific skillsets needed for the cutting-edge vessels. Another key ambition is the creation of a green ammonia corridor in Southeast Asia to facilitate the bunkering of these vessels. This will mean establishing zero-emission maritime routes between two or more ports, together with the development of bunkering facilities and other supporting infrastructure.

AET also signed an MOU with PTLCL to explore the deployment of a zero-emission Aframax. AET will select the shipyard to build the ammonia-powered dual-fuel tanker for planned delivery to PTLCL for long-term charter by 2026. Both parties also intend to work together on the design, safety and operational aspects of the vessel. They will also join hands to study the creation of a green ammonia corridor in Southeast Asia.

POTENTIAL APPLICATION OF AMMONIA AS A SHIPPING FUEL



AMMONIA: A POTENTIAL PATHWAY TO A ZERO-EMISSION FUTURE FOR THE SHIPPING INDUSTRY

Ammonia is among the zero-emission fuel options or pathways that can potentially drive shipping decarbonisation. Ammonia is produced and has been used in large quantities in other industries for decades, where there is available knowledge on its handling, storage and operation. As a cargo, ammonia is a familiar product to the shipping industry where it has been transported in Liquefied Petroleum Gas carriers subject to existing regulations such as the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

The core ammonia production process is Haber-Bosch synthesis, a process that combines nitrogen with hydrogen to produce ammonia. The production of hydrogen can make the ammonia "grey", "blue" or "green" depending on the feedstock and production process. Grey ammonia is the most common form where hydrogen is generated from fossil fuels through a process called "steam methane reforming". Blue low-carbon ammonia is essentially like conventional grey ammonia coupled with carbon capture, which can reduce its carbon emissions by more than 90%. Green ammonia uses green hydrogen produced by water electrolysis powered by renewable energy, making green ammonia production virtually CO_2-free.

Ammonia boasts a number of advantages that make it a promising fuel to support the decarbonisation of shipping. Naturally carbon-free, it can drastically reduce the GHG emissions on a well-to-wake basis, provided it is produced using sustainable energy sources. When using ammonia as a fuel in a marine internal combustion engine, the emissions of sulphur dioxide, carbon monoxide, heavy metals, hydrocarbons and polycyclic aromatic hydrocarbons (PAH) drop to zero. This is because ammonia has no carbon, sulphur and other contaminants typically seen in conventional residual or distillate fuels.

BARRIERS REMAIN

However, there are barriers to the adoption of ammonia as a fuel that the industry, engine manufacturers, producers and other industry segments, as well as policymakers and regulators, need to address in a collaborative manner. Despite the shipping industry's extensive experience in handling ammonia as a cargo, it has limited knowledge on using ammonia as a fuel.

Given that ammonia is toxic and corrosive, there are concerns over the safety of using ammonia as a fuel on board ships and their engines. Issues related to NOx and nitrous oxide (N_2O) emissions as well as the detrimental effects of ammonia slip from engines will need to be addressed. The formation of N_2O is a potential risk as it is a potent GHG. Further work on understanding these risks and their possible mitigation is needed. Additional guidelines and regulations will also be needed because of the increased number of operations (such as bunkering) and increase in human interaction with ammonia when the uptake of ammonia takes place.