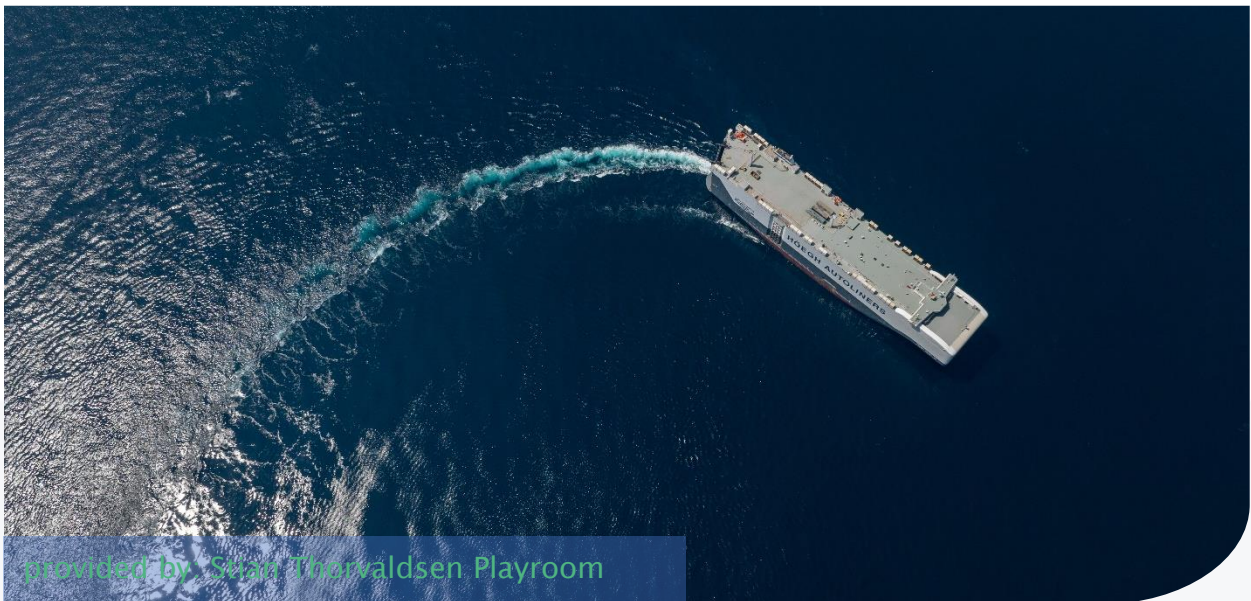


TGE Marine, together with Höegh Autoliners Chart a Sustainable Course with Ammonia-Powered Aurora Class Vessels



Picture: The twelve multi-gas tanks granted DNV's ammonia- and methanol-ready notations, are the first in the PCTC segment that can be converted to zero-carbon ammonia – The AURORA Class are the world's largest PCTC vessels

Höegh Autoliners has revolutionised maritime transport with its Aurora Class vessels, marking significant progress toward sustainable deep-sea shipping. These Pure Car and Truck Carriers (PCTCs) are designed to be the largest and most environmentally friendly in their class.

Notably, the final four ships in this 12-vessel series are set to operate on sustainable ammonia, a zero-carbon fuel, upon their delivery in 2027.

The Aurora Class vessels are initially running on liquefied natural gas (LNG) with the flexibility to transition to ammonia or methanol as these fuels become more accessible. This adaptability is emphasised by the ships' receipt of DNV's ammonia- and methanol-ready notations, a first in the PCTC segment.

The final four vessels will feature *MAN Energy Solutions'* two-stroke engines capable of being fuelled by ammonia, positioning them as pioneers in zero-GHG emission maritime transport.

A key enabler of this technological leap is **TGE Marine**, whose advanced tank designs and fuel gas handling solutions are at the core of the vessels' ammonia propulsion capabilities. TGE Marine's expertise in designing and engineering maritime gas systems has made them a global leader in gas containment and fuel supply technologies. Their tanks are specifically developed to safely store ammonia in maritime conditions, while their fuel gas systems are among the most advanced in the industry ensuring reliable fuel management, safe operations, and seamless engine integration. These solutions exceed the stringent safety and performance standards required for ammonia as a marine fuel.

TGE Marine has already supplied tanks and fuel gas systems to the first eight Aurora class vessels, and within the final four vessels, the fuel supply system is intended to handle ammonia fuel which allow for the vessels to be an engineering front runner in the industry.

The new ammonia fuel supply system comes among others with a reliquefaction system, a gas combustion unit (GCU) and an ammonia release and mitigation systems (ARMS). The following expands on the specific aspects of TGE Marine's contribution to the vessels:

Fuel Supply System: The fuel supply system is streamlined to support the main engine operation in an optimum manner allowing a reliable and stable operation with ammonia as fuel. The design of the system is addressing the demand to increase ammonia integrity and to allow safe operation incl. maintenance. Key design features are the utilisation of sealless pumps, high integrity equipment and automation resp. remote operation.

Boil-off Gas (BOG) Treatment: The heat ingress into the ammonia storage tank will lead to evaporation of ammonia. To keep the tank pressure within allowable limit the vapor, the BOG, is routed from the type-c tank's vapor space to the BOG Treatment System. The BOG Treatment system consist of two fully independent methods to manage the tank pressure, i.e. the Reliquefaction System and the Gas Combustion Unit (GCU).

Reliquefaction System: Onboard reliquefaction systems are engineered to recondense the ammonia vapor those results from heat ingress into the storage tanks and system operation.

Gas Combustion Unit: As with all systems, TGE Marine also ensure that in an unlikely event that the reliquefaction system would fail, a secondary 'back up' system would kick in. The method chosen for this set up a gas combustion unit (GCU). This method burns the boil off gas, and this allows the tank temperature and tank pressure to remain within

the limits. The gas combustion unit can support also the treatment of nitrogen ammonia mixtures and non-standard operations, such as gas-freeing of systems for maintenance preventing the release of ammonia to the atmosphere.

Safety Systems: Key for operating a vessel with ammonia as fuel is the safe operation taking the toxicity of ammonia into consideration. TGE Marine has implemented safety systems and measures into the design of the system. Risk assessments accompany the design and execution of the project at every stage.

Ammonia recovery: A key element of the safe operation is the handling of potential operational and emergency releases originating from fuel supply system and engine purge operations. For this purpose, an ammonia recovery system is applied to reduce the ammonia quantities being routed to the ammonia release mitigation system.

Ammonia Release Mitigation System: The ammonia release mitigation system developed by TGE Marine, is reducing the ammonia quantity released to the atmosphere and ensures that ammonia concentrations are below health and safety limits

To underline the benefits of the system, these following can be listed as primary benefits of using such configuration:

- ✓ **Fuel Efficiency:** By applying an efficient ammonia fuel supply system and ammonia engine
- ✓ **Environmental Compliance:** Minimising emissions of ammonia gas into the atmosphere reduces the vessel's environmental footprint and helps comply with stringent emissions regulations
- ✓ **Safety and Stability:** The system ensures stable operation, reducing the risk to personnel and enhancing onboard safety
- ✓ **Operational Flexibility:** This technology supports extended voyages without fuel losses and allows better management of varying fuel demands during different operational profiles

Beyond propulsion, the Aurora Class vessels incorporate several eco-friendly features, some include 1,500 square meters of solar panels and the capability to connect to electric shore power, enabling emissions-free port operations.

With these advancements, Höegh Autoliners, together with key partners like TGE Marine, is not only reducing its carbon footprint but also setting a new standard for sustainability in maritime transport, steering the industry toward a greener future.

Introduction: TGE Marine Gas Engineering GmbH (TGE Marine)

TGE Marine

THE GAS EXPERTS – Innovations for Greener Shipping

45+

years of experience

250+

gas tankers

400+

cargo and fuel gas
tanks

100+

fuel gas systems

1

crew

Since 1980 TGE Marine is the leading liquefied gas systems' provider for

- LNG/LEG/LPG/NH₃ Gas Carrier
- Bunker Vessels for cryogenic gases
- Fuel Gas Systems (LNG, Ethane, LPG, NH₃ and future fuels)
- Ammonia (NH₃)
- CO₂
- Floating Units

With our passion for innovation. We are supporting the industry with technical solutions for a sustainable future.

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